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CORRECTIONS

Mr. Benjamin Greenstein calls to my attention the fact that an error in sign has inadvertently crept into Table IB of my article, "On the Simultaneous Determination of the Elementary Regressions and Their Standard Errors in Subsets of Variables" (September, 1937). On page 522, the section beginning "From line 6" should read:

$$P_{22} = \frac{-\Delta_{2344}}{\Delta_{3344}} P_{23} - \frac{\Delta_{2334}}{\Delta_{3344}} \cdot P_{24} + \frac{1}{\Delta_{3344}}$$

$$P_{12} = \frac{-\Delta_{2344}}{\Delta_{3344}} \cdot P_{13} - \frac{\Delta_{2334}}{\Delta_{3344}} \cdot P_{14} - \frac{r_{12}}{\Delta_{3344}}$$

JACOB L. MOSAK

In the article by H. Muench on "Discrete Frequency Distributions Arising from Mixtures of Several Single Probability Values" which appeared in this JOURNAL 33 (1938), 390, a correction should be made on page 392. The third line of equation (7a) should read:

$$k = a^{r+1}/r! \text{ where } \Sigma y \text{ is put equal to } 1 \text{ and } r! = \Gamma(r + 1)$$

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THE STATISTICAL EQUIVALENT OF GOLD*

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IN THE RELATION between gold and monetary policy there exists at the moment a curious paradox. For four years the United States has bought gold at one fixed price and when the movement of funds was outward has sold gold at a fixed price. The fixed buying and selling prices have maintained the international value of the dollar. In that respect we have followed the operating practice of the gold standard more nearly than almost any other country. At the same time our domestic monetary policy is less influenced by gold than that of most other countries, and less influenced by gold than ever before in our own history. Quite aside from changes in monetary laws our gold holdings have been so huge that domestic monetary policy is largely independent of gold.

In a relatively short time, as human institutions develop, we have gone from a largely automatic currency system based on gold to what is in large measure a managed currency. We have not done this all in one leap, or by accident, or in the main as a part of the New Deal. The longest step was taken twenty-three years ago when the Federal Reserve System was established. It was indeed a longer step than was generally recognized at the time. Little was said about credit control in the discussions of the bill, nor did the Act itself define objectives for policy, except to say that discount rates should be fixed "with a view of accommodating commerce and business." This phrase, and others in the Act, suggest a mechanism for supplying business with a little extra money now and then for seasonal or emergency needs rather than the continuing control of credit. Nevertheless the framework of the System with few changes was adequate for a much larger function. The war gave the first impetus for expansion of both objectives and operations. War was also responsible for a reversal of this country's international position and a huge inflow of gold, again providing both the incentive and the material for a further growth of function. The depression, another vast increase in the gold supply, and a change in the

* Presidential address at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, December 28, 1937.

nation's political-economic philosophy have moved us further in the direction of monetary management. We have come a long distance and find ourselves in a country far from the point where we started.

We may well ask ourselves how we may find our way about in this new country. Where do the different roads lead and what do the signposts in these strange new languages, such as are invented by Mr. Keynes, mean. It was, at least in theory, simple enough in the old days. The gold supply operated directly on the money supply. It was the business of the central bank, where there was one, to protect the gold reserves. This guide to policy was sometimes blind and arbitrary, but it was definite and convincing. In the present strange new world, where the old gold portents have lost their former meaning, where is the radio beam which the central banker and others may follow? What is the statistical equivalent of gold?

The change from a semi-automatic gold standard to a far more flexible currency system, more subject to management, has I believe greatly increased the opportunities and responsibilities of the professions represented in this meeting. If the money mechanism were more automatic, or could be operated by rules and traditions alone, the responsibility for its operation could conceivably be left without much concern solely to a group of technically trained specialists. But when the bank of issue is facing such new problems in such a new situation, its success will depend in some considerable measure on the capacity of our two professions for applying to these problems the techniques of economic and statistical analysis, not alone for the benefit of the officers of the central bank, but for the guidance of political and public opinion.

I am tempted to suggest that in some degree our two professions have brought this problem on themselves, for the wider and more general responsibilities of the Federal Reserve System, and of other central banks as well, are due not solely to the force of circumstances, but also to the trend of economic thought, which has favored more and more management. It is therefore only fair that we should aid the central bank in its search for the statistical equivalent of gold.

There is gradually growing up a literature on this subject, most of it very recent, and most of it too general in its terms to be of much immediate use to the central bank. Some of it is badly in need of the services of a sound statistical practitioner. Even on basic principles there is far from general agreement. As to experience there are only a few years during which banks of issue have had anything approaching the present freedom of action, and these years have been so abnormal in their political and economic setting that results are hard to evaluate.

In the interest of a proper humility it should perhaps be added that the greater freedom for management of money has not thus far yielded greater economic stability. The years of increased management have witnessed the widest business fluctuations for which we have records. But the times have of course been abnormal. Powerful non-monetary forces, including the sequelae of war, have been disrupting. The lessons of this experience are far from clear.

I have no intention this evening of attempting to set forth an original solution of these problems, but what I propose to do is to outline more specifically some of the sorts of problems involved in finding a sound basis for central bank policy.

It is perhaps natural that the first object of search should be some single index which would be as simple and convincing as the gold ratio. Such an index would be a great comfort. It is fitting that we should pay our respects to several indexes which have been suggested to fill this important role.

Commodity Prices. Among possible guides to credit policy commodity prices should always be mentioned first, not alone because of their importance but also to avoid giving offense. For in this context commodity prices are the object of a form of religion, and price stabilizers have all the fervor of the most evangelical sect. Seek this first "and all these things shall be added unto you." Few feel so strongly about production, employment, or other possible guides to policy. Prices are certainly some measure of the kind of changes in the economic structure for which the central bank must be on the alert. They usually are sensitive to overexpansion or to incipient depression. But they and their interpreters are, alas, frequently misleading and confusing guides.

In the Macmillan report, for example, the stability of international prices is repeatedly emphasized as the main objective of monetary policy, but there is the qualification that before they are stabilized prices should first be put up a little,—just how much the report does not say. This report was slightly aggrieved because during the period of the 20's the United States was not letting gold imports cause an upward movement of prices. On the other hand Professor Phillips and his associates in their recent book¹ tell us that a policy of price stability was all wrong in this country in the twenties, because the normal trend of prices was downward. In 1928 the signs were certainly confusing, for commodity prices were level or declining at a time when most of the other signs showed the need for a policy of restraint.

¹ C. A. Phillips and Others, *Banking and the Business Cycle* (New York: The Macmillan Company, 1937).

There are other difficulties as well. How about the situation today? In relation to the debt structure, prices probably ought to be higher than they are now, but how high, and how fast should the movement be? One trouble with price stability as an aim is that you have to start somewhere, and nobody knows quite where.

May I suggest also that if a price index is to be compared with the changes in bank credit it must be broader than commodity prices alone. I suspect that wage rates and rents and the cost of living are just as important, and even, we are now willing to admit, the prices and yields of securities. More attention may well be given to relationships between the movements of different sorts of prices. But even these broader price studies, helpful as they may be, are not by themselves an adequate guide to policy.

Production and Employment. The time-honored formula recognized by the Reserve Board in its 1923 Annual Report was to the effect that danger signals were run up whenever production was operating to capacity and there was full employment. Beyond that point supplies of credit were likely to result in competitive bidding for products. The formula still commends itself. It was especially applicable to the situation at the beginning of 1923. But it was not much help in 1928 and 1929 when there was still some leeway in plant capacity and in employment, and yet later events apparently showed that overinvestment had been taking place at least in certain directions.

The movement of the production index alone is moreover an inadequate guide for credit policy for intermediate movements, like that of late 1936 and early 1937, when the rate of increase proved to be more rapid than could be sustained although operations generally were far short of capacity. Of course, also, the mere fact of large and continued production of capital goods should not of itself be an indication of the need for restraint. There is no inherent reason known to us why the rate of growth of the standard of living, or per capita production, in this country should not be more rapid than, let us say, the two per cent per annum rate to which we have become accustomed.

The production index therefore is not the magic figure we are seeking as a guide to policy. Recent efforts towards breaking down this index into significant parts which might show the extent of capital investment as distinguished from production of non-durable goods have not yet gone far enough to justify conclusions as to their utility for the central banker, but they give promise of revealing some further knowledge of the nature of business fluctuations.

Volume of Bank Credit. Another index which over a period of years has established some claim to consideration as a guide to policy has

been the rate of growth of bank credit. The studies of Carl Snyder have shown that when the growth of credit has departed from the usual long term rate of growth of the country's business, it has been an influence towards instability. But like every other index this one has gone bad from time to time. In 1928, for example, bank credit stopped increasing, but the increase in velocity, partly stimulated by lending of other agencies (security loans "for account of others"), more than made up. As in the case of prices a rule of reason is required in the interpretation. In addition to changes in velocity the rate of recently preceding growth or decline must be considered. For example, after the violent decline in the volume of credit at the time of the banking holiday a more than normal increase was a healthy expectancy, and after the very rapid increases of 1933 to 1936, largely due to government deficit financing, some pause in the rate of growth seemed reasonable and likely to be compensated by some increase from a very low velocity. Just as in the case of prices some assumption must be made as to the starting point before the formula will operate. So even this valuable index may not be accepted as the sole guide.

One might extend considerably this list of pretenders to the throne of gold, but in each instance we should be likely to discover some flaw in their lineage, some sound reason why they should not be elevated to the crown. Some of them might with reason qualify as members of the privy council, but they do not deserve royal status.

To use still another analogy the search for a single gold equivalent appears in the present state of our knowledge much like the search for the spring of perpetual youth, or for the pot of gold at the end of the rainbow.

This disqualification of a sole guide to policy becomes clearer perhaps if we visualize in real rather than abstract terms some of the decisions which must be made by central banks. There is, for example, always the difficulty of maintaining the balance between long term and short term objectives. Let me illustrate. During the period of the twenties the Federal Reserve System made a vigorous attempt to use its powers in the interest of economic stability. It was this country's most conscious attempt up to that time at the management of money for the public good. You will recall particularly the open market purchases of government securities in 1924 and 1927, and the sales in 1925, 1926, and 1928. When business declined, the System made money more freely available, and when it recovered, the System withdrew funds from the market. I quote from Hawtrey, "The American experiment in stabilization from 1922 to 1928 showed that early treatment could check a tendency either to inflation or to depression in a few

months, before any serious damage had been done. . . . The American experiment was a great advance upon the practice of the nineteenth century."²

Many others have been kind enough to give the Reserve System credit for successful achievement in that period. But that, alas, is not the whole story. Let me quote from Wesley Mitchell, "For we think that the violence of convulsions such as occurred in 1907-08, 1920-21 and 1929-33 is due largely to the partial character of the liquidations effected during mild contractions, . . . "³

This conclusion, based on long study of the behavior of business fluctuations, surely gives one pause. In both 1924 and 1927 the Reserve System recognized the possibility of business depression and took action promptly to cushion the decline. I have no doubt that its action played a part in lessening the severity of those recessions. Is that not proper procedure in monetary management? And yet does not Dr. Mitchell's conclusion lead one to wonder if we should not have fared better with less monetary management? If nature had taken its course and those minor recessions had been permitted to be more severe, they might perhaps have forced some readjustments in the economic mechanism and left less to be done when the big depression came in 1929.

It may be that the business process requires at relatively frequent intervals periods of readjustment, and if these are shortened or avoided, the result in the long run is a more serious readjustment. If that is so, a number of interesting deductions suggest themselves. One is that monetary policy is a long term problem and that the results of any policy may not safely be judged for perhaps a decade. It may be even longer before we may judge, for example, the usefulness of stabilization funds as monetary mechanisms. It may be two or three decades, five or more presidential terms, before we know the results of the devaluation of the American dollar, and the results generally of operating with flexible currencies. Another conclusion is that we are dealing in the business cycle not simply with a wave of psychology or with a short term commercial banking and current inventory fluctuation, but rather with the whole investment cycle.

At least this is clear: that credit control has two aspects, a long term and a short term; and one of the hardest problems of all is to determine the relative weights to attach to each aspect. Apply the question today if you will. The long range problem appears to be the avoidance of inflation. The short term is to get out of depression. How much is it safe to run risks on the first problem in order to deal with the second?

² Hawtrey, R. G., *The Art of Central Banking* (1932), p. 300.

³ *National Bureau of Economic Research Bulletin*, No. 61 (Nov. 9, 1936), p. 2.

We now have one billion dollars of excess reserves. Is that enough to give the proper encouragement to reflation? Is it so much that the underlying inflationary tendencies are unduly encouraged? Is such long continued cheap money sowing the seeds of disequilibrium? The Reserve System would, I am sure, be glad to have our suggestions on this point; now rather than five or ten years hence.

A second puzzling problem which is interwoven with that just discussed concerns the relationship between monetary and non-monetary influences on business fluctuations. Again let me illustrate by a comparison between the depressions of 1920-21 and 1929-33. In the earlier period business and prices reached their high points in the first half of 1920 and declined rapidly in the autumn, so that by December they had made a considerable nose dive. Federal Reserve discount rates which had been raised to 7 per cent in June had not yet been reduced. The records show that in December the question of a lowering of discount rates was carefully reviewed. The conclusion was drawn that, while wholesale prices had declined precipitously, the necessary adjustments had not yet taken place in retail prices and the cost of living, and in industrial costs, and it was therefore unwise as yet to reduce the discount rate. To put the matter in modern language the officers of the System felt there was still disequilibrium in the non-monetary factors and that necessary adjustments would be made more readily and fully with high than with low discount rates. The rate was not changed for several months. Was this wise policy or not? In any event, recovery began in the middle of 1921 and was rapid and continuous.

By contrast what happened in the recent depression? In this presumably more enlightened period the Reserve System was much more prompt and reduced discount rates and bought large amounts of government securities within a few weeks of the onslaught of the depression. Other governmental agencies mobilized for action. Business came to the rescue with large programs of capital outlay. Nevertheless the depression plumbed lower depths than in 1921 and has lasted far longer. Now may we infer that if we had all been less enlightened and had been content to see nature take its course, at least in the earlier stages of the depression, that disequilibria might have been corrected earlier and the depression shortened? Or shall we conclude that monetary policy is impotent in the face of dominant non-monetary influences? The only conclusion which seems wholly safe is that we are painfully ignorant as to the interaction of these great forces.

One way of visualizing certain phases of the relationship between monetary and non-monetary influences is to be found in the distinction between cheap money and easy money. Usually the two go together,

but at the present time their paths have separated. The rates for short money and for prime bonds have been the lowest in the history of the country, and yet because of a feeling of uncertainty as to the future, the position of the borrower is scrutinized with the utmost care, and money is not easy to obtain for any but prime borrowers. It is an illustration of the limitations of the power of the central bank to influence even the effective supply of money. Non-monetary influences are preventing the large volume of funds which are available from flowing into any but restricted channels. Thus while quoted money rates are low, money is not really easy. It is perhaps influences of these sorts which mark the difference between the depression in 1920 and 1921 and that from which we have gradually been emerging.

These two problems of the balance between long term and short term policy and the relationship between monetary and non-monetary influences illustrate the complexities which the central bank here or in any other country faces when it departs from the automatic procedures of the old gold standard and seeks a statistical equivalent. They show, it seems to me, the inadequacy of any single series of figures now available as a guide to policy. They seem to me also to define the scope of the problem. Monetary policy is not something by itself but is simply one phase of a complex flow of economic forces, constantly changing in form and in human consequences. We cannot direct policy wisely until we understand far better than now the stream of economic fluctuations in which that policy plays a part.

I am impressed particularly by how much more needs to be known about the longer term forces which influence business fluctuations. For example, it is often stated that a downturn in business is frequently brought about by increasing costs and declining profits, but there is sorely needed an analysis of the actual changes in business balance sheets and profit and loss statements which mark this turn. Is it perhaps true that the causes of the turn do not show in these statements and that the higher costs which are a deterrent are those which never occur but are anticipated, which prevent plans from passing beyond the blue print stage? Building costs today are perhaps an illustration.

Another direction of study of long term trends which seems likely to be fruitful is a closer analysis of the investment process and the relations within it of monetary and non-monetary influences. The person who borrows funds at long term for investment in enterprise must be convinced of his capacity to make profits over a long period. This involves a prediction as to selling prices, volume of sales, cost of material, wage costs, taxes, and freedom from ruinous competition. The lender of funds must have the money, and must be convinced not

only of the character of the borrower but also of his capacity to earn a profit. The influence of monetary policy on this operation is usually indirect, in maintaining a stable or easy money market, which will encourage investing. It may of course supply funds which banks invest. Perhaps its most valuable contribution is in discouraging periods of excess in which too much bank funds go into investments, tending to produce overinvestment, and in maintaining sound credit conditions as a basis for a sound investment market. Clearly in the whole investment process monetary policy is only one of many factors in producing the result, and its success or failure will be largely conditioned by other factors. This is a process considerably different from the round of short term commercial lending in which the function of the central bank has traditionally been defined. The importance of a better understanding of the investment process is recognized in this program in a series of joint meetings of the Economic and Statistical Associations on the "Influence of Various Factors on Fluctuations of Investment." These meetings move in the direction of supplying the central banking system with the kind of information it needs.

Now if the foregoing analysis is in any way correct, we cannot hope to find a single index which will be the statistical equivalent of gold. Central banks must determine their policies in the light of the whole flow of economic fluctuations and especially the fluctuation of investment. Central banks therefore cannot be run by statistics alone but must rely on the judgment of prudent and informed men. But the judgment of these men will be better as further advance is made in the analysis of all these problems. In this task the Reserve System is in large degree dependent on the professions here represented.

I cannot conclude this paper without mentioning a related central bank problem which is not precisely statistical in nature, but in which the members of these two societies may be of great aid towards the pursuance of sound policy. The bank of issue has two problems: one is knowing what to do; and the other is getting away with it.

The old semi-automatic gold standard had one great advantage not often mentioned: its decisions were accepted as necessities. When the bank rate was raised because of a decline in the gold reserves, the decision was not arbitrary; it might not be liked but it came in the same general class as the rain or the snow from heaven. It was in effect an Act of God. Not only so, but the position of the gold reserve has frequently been a persuasive argument for the balancing of the national budget or other legislation needed at critical times. The decisions of the central bank on broad economic grounds have no such persuasive force.

I am reminded at this point of Henley's poem, a part of which reads:

In the fell clutch of circumstance
I have not winced nor cried aloud;
Beneath the bludgeonings of chance,
My head is bloody but unbowed.

Do you suppose the brave stoicism of this poem is fairly representative of the reaction of human beings who may feel, justly or unjustly, that they have been injured by some act of the central bank which might be regarded as arbitrary in character? Would it be possible for them to say

In the fell clutch of the central bank
I have not winced nor cried aloud;
Beneath the bludgeonings of money management
My head is bloody but unbowed?

We may well recall how the embattled farmer answered this question in 1920. After the so-called deflation policy of the System in 1920, which we would criticize today only for its lateness, the political outburst from agriculture was swift and deadly. In 1929 the memory of the 1920 political reaction was still vivid and probably explains some of the reluctance to take vigorous discount rate action. When action was taken its effectiveness was lessened by the huge gold reserve in the background. High rates were regarded as arbitrary and artificial. To-day low rates lose something in effectiveness for the same reason. But the real test comes when the central bank undertakes to tighten money, "arbitrarily."

As long as the bank of issue was charged simply with the duty of protecting the country's gold reserve and so was presumed to be operating in a technical and limited field, it could claim some measure of protection from political pressure. But once the philosophy of monetary management is adopted, and policy decisions become as broad as the general welfare, freedom from political interference becomes a constant battle. The experience of managed currency systems is limited, but no such system has yet demonstrated its power to win that battle.

By the force of circumstance and the force of the stream of economic opinion this country has accepted a large measure of monetary management. As students we have responsibility for developing information and understanding on the basis of which wise decisions may be made. We have also the responsibility of interpreting the functions of the central bank to the people of the country, so that they will preserve its freedom of action. If these tasks are beyond our fulfillment

we should be the first to recommend the abandonment of the general plan and the return to some more automatic system.

In his essay "The Moral Equivalent of War," from which I have purloined my title, William James points out that "war has been the force that can discipline a whole community." If there were no war the problem would be to find other means by which we might "subject ourselves collectively to severities." The gold standard was a mechanism in the financial field by which we might "subject ourselves collectively to severities." Can we and will we do this without the pressure of a limited gold reserve? It is always easy to rationalize the path of least resistance, of indefinite monetary expansion. This way of financial life has many persuasive apostles. Political pressure is always in this direction. The only salvation from this danger lies in an informed public opinion, and the source of such an opinion must be our two professions.

CHANGES IN CAPITAL FINANCING*

BY DONALD B. WOODWARD
Moody's Investors Service

AN ATTEMPT to discuss the capital financing of business immediately meets two major difficulties. The first is the lack of preciseness of the vocabulary, an inexactness so serious as to cause many misunderstandings. The second difficulty is the lack of measurements, either statistical or financial, by which to study the subject.

The difficulty with the vocabulary in which the subject of capital financing of business must be discussed, arises primarily from the fact that the words are taken partly from classical or academic economics and partly from accounting. They are such terms as capital, savings, investment, depreciation, depletion, income, and earnings. In neither economics nor accounting is the meaning of such words exact.

What is the capital of business or a business? Balance sheets give a dollar figure, but what does that mean? It represents plant, equipment, goodwill, patents, working capital and miscellaneous other items valued at a dollar total. This dollar total represents a figure arrived at on the basis of cost perhaps including write-ups, to which various adjustments have been made over a period of time in an attempt to allow for depreciation, depletion, obsolescence, retirements, maintenance, changes in commodity prices, additions to capital and other factors. Have these adjustments been accurate? Who can say? The number of failures, defaults, and forced adjustments that have been necessary over a period of time indicate that they have not been precise.

Perhaps the market value of the assets, in whatever terms defined, might be taken as a standard. But who would buy the total assets of United States Steel, or American Telephone and Telegraph, or Pennsylvania Railroad? Even if there were bidders, what basis would they use to arrive at a price?

Presumably the standard which such hypothetical bidders would use would be the income which the property would or could be expected to produce. Physical property, or patents or goodwill, generally speaking, have no value unless they will produce income. The history of the traction industry, and others, indicates this fact. But what are business earnings?

They are the income remaining after expenses. But expenses include

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depreciation, depletion, and maintenance, the inadequacy or excess of which may make true earnings and reported earnings very different figures.

The second difficulty in approaching the subject of business capital financing is that there are very few pertinent or relevant figures for business as a whole, and none which are complete or comprehensive. There are only disjointed fragments, which are often more misleading than informative. This inadequacy of statistics or measurements, which is a reproach to our profession, seriously limits our knowledge of this most vital matter. When we speak of financing business capital expenditures, we have no figure to measure such expenditures in most lines of business, and no figures which permit an analysis of the sources of funds spent over any period of time. Business expenditures of a capital nature as opposed to those made in operation, are not the amount of durable goods purchased by business, for in such total purchases, even if we knew them, would be included those for maintenance. The amount of capital expenditures is not indicated by changes shown on most balance sheets for plant and other such items, for these are net after many adjustments, and as a result the actual outlays on plant are hidden for the period in balance sheet figures. So far as I know, there are no figures available measuring capital outlays of American corporations, or any group of them which can be related to financial figures over any substantial period of time except some for the railroads which are obtainable with great difficulty. Furthermore the meaning of most figures is limited by the fact that they are available at twelve-month intervals; a year does not, in most businesses, represent the normal operation cycle.

Analysts are accustomed to use some series of figures as representative of such expenditures. The most often used are the totals compiled by the *Commercial and Financial Chronicle* for new issues less refunding. According to the careful studies of Mr. Adam Gostomski of Moody's, however, that series is not at all representative. During no one of the last 15 years can as much as 80 per cent of that total be classed as business financing productive of activity, and in most years the percentage is far less, being as low as 34 per cent in 1929. This is due to the large amount of purely financial issues in the *Chronicle* series. I think that the series developed by Mr. Gostomski is far superior to the more usually used *Chronicle* series, but by no means is it representative of business capital outlays, representing only that portion of funds obtained in the capital market, which clearly is a varying percentage of total outlays.

I suggest that in considering capital expenditures and capital financ-

ing we adopt a strictly financial concept. I believe that this procedure will get us closer to the realities both of financing and of business developments. Let us try to get a concept of where cash comes from and where it goes.

Cash comes to the corporate treasury from a variety of sources: sales of merchandise and services, sales of securities, sales of assets, short term borrowing, etc. Cash goes out of the corporation treasury for the purchase of labor, materials, services, for the payment of dividends and interest, retirement of securities, etc.,—in short, for a variety of types of expenditure.

I suggest that we consider capital expenditures those expenditures which result in additions to assets or are designed to preserve, aside from the ordinary operating expense of maintenance, the condition of the plant. These would include expenditures made in replacement of assets on account of depreciation and depletion.

The physical goods required for additions to and in preservation of assets by business is one measure of gross capital formation by business. And if we reduce this by the depreciation and depletion actually incurred, the residual total may be termed net capital formation by business in the physical sense. I believe that such a definition roughly agrees with those which Dr. Simon Kuznets uses in his most excellent studies, though not precisely. The capital financing of business therefore is the financing of gross capital formation by business.

With such a definition of what is meant by the capital financing of business, the sources of cash which cover these outlays can be seen with some clarity. They are first, net sales of securities and, second, working capital, consisting of a number of fluctuating items and reflecting earnings retention and depreciation policy. Cash may be obtained from working capital by the conversion of short term assets or by expansion of short term borrowing.

These are the chief and preponderant sources in terms of corporate finance. Underlying these and bearing on all of them, however, is the total supply of money in the country and the activity of that money. In the past, except during the World War, both supply and activity were closely related to changes in long and short "payables" of business. During recent years this has not been true, since an extra business agent has been in operation—the Government. Therefore, as an underlying source from which cash has come, through gross income of business, the Government's influence on the total supply of money must be kept in mind. The Government's borrowing from the banks has resulted in an expansion of the supply of money, the expenditure of which has put a considerable amount of cash into corporate treasuries.

If the corporations had borrowed directly, they would have had to pay interest; as it is they must pay taxes. The cash came to them just as if they had borrowed, but through a different channel; they will have to pay current charges and provide for retirement, but by a different process.

The figures available to measure these points and to permit conclusions as to the trend, if any, are fragmentary and incomplete as I have warned you. But in combination they appear to be sufficient, to permit some tentative conclusions, which, if proved true by later investigation, are very significant.

Let us look first at the recent recovery period, 1933 to mid-1937. The outstanding fact of that period was that the country experienced an upward movement of capital expenditures by most lines of business of almost unparalleled rapidity. But the capital markets financed that recovery only to a negligible extent, the new issue market, aside from refunding operations, being most noteworthy by its absence. It is clear, therefore, that the cash which paid for these expenditures came from other sources than net sales of securities.

The actual source has been working capital, which had been built up in the past partly from retained earnings, partly from the fact that amounts reserved for depreciation and depletion had been greater than capital expenditures, and partly from other operations. Working capital was large when the recovery began, and could be drawn down. And earnings, which were being realized after a long dearth, were in substantial part retained in the early part of the recovery.

Beneath these, government deficit financing from the banks was adding rapidly to the supply of money, the expenditure of which by the recipients put cash into corporate treasuries through their sales of goods and services. And the large government budget contributed to the activation of the supply of money which worked toward the same end. To some extent, this government spending and deficit financing made it possible for corporations to have earnings—certainly larger earnings than they otherwise would have had.

In order to describe more precisely what happened, I shall draw on three sources of figures, all thus far unpublished, though I trust that all will presently become generally available. These are studies by Dr. Alexander Sachs of the Lehman Corporation,¹ by a W.P.A. research project in New York sponsored by the S.E.C., and a study by Moody's. The study by Dr. Sachs has, for the first time, analyzed the sources of funds for business capital expenditures, and their uses, for a number

¹ Dr. Sachs' study has since been published in summary in *The Annalist*, Jan. 14, 1938, and in a bulletin of the American Management Association.

of representative corporations, and is the first complete study of which I know. The S.E.C.—W.P.A. project is tabulating the reports of corporations filed under the Securities Act of 1933 and the Securities and Exchange Act of 1934, the excellent forms for which require the disclosure of sufficient information to make possible a picture of the method by which business operations are financed; as time passes, if these forms are kept in effect as I fervently hope, we will eventually have adequate figures over a sufficient period of time to be able to understand better the process of business finance.

In 1933 and 1934, Dr. Sachs' study shows that the corporations' capital expenditures were much less than they reserved for depreciation, they had income deficits, were repaying obligations to banks and the capital market net, while cash declined, inventories and receivables, and current liabilities rose. In 1935 gross plant additions and depreciation charges were about equal, obligations to banks and the capital market were still being repaid, there were substantial retained earnings, and working capital diminished. In 1936 gross plant additions substantially exceeded the amount reserved for depreciation, undistributed profits fell and working capital fell. In short, working capital provided the preponderant portion of the funds which business required during the period, and for the four years there was a substantial net repayment to the banks and the capital markets combined.

The research project figures have not been completed to such a point, but they show, for a representative number of steel companies that while balance sheet items of fixed assets declined in both 1934 and 1935, there were nevertheless substantial expenditures for additions to assets each year.

To approach the subject statistically from a different angle, Moody's studies show that a series made up of the total of retained earnings of corporations, new issues, mortgage financing and a portion of government deficit financing after excluding government spending for purposes clearly not productive of business activity, such as the placing of preferred capital in banks, moves very similarly to an index of investment goods activity. If a satisfactory method were found to add in expenditures from working capital I am satisfied that the similarity of movement would be even closer.

Time does not permit me to present all of the figures of these various calculations. In general terms, however, I can sketch what rather clearly has happened in the course of the past five years to business capital financing.

In 1933 and 1934 business as a whole held its own and probably accumulated some funds. In 1935 and 1936 and early 1937 capital

outlays rose sharply, taking from working capital all of the amounts reserved for depreciation, and causing working capital to diminish sizably. Funds from the capital markets were inaccessible or unnecessary in any consequential amount. The diminution of working capital finally in 1936 sent the corporations to the banks for considerable amounts, particularly as the tax on undistributed profits became operative. Studies by Dr. Willard Thorp at Dun and Bradstreet show that this tax had marked effect on dividend policies. The rising demand for loans on the banks together with the Federal Reserve action in raising reserve requirements caused heavy bank selling of bonds in 1937 preventing a new issue market just at the time when business needed such a market most. At the same time government financing in the capital market ceased, and public debt was demonetized in large amounts, shrinking the supply of cash.

Experiencing a working capital and cash position which was the poorest in more than a decade² and going lower, unable to replenish it in the capital markets, and being pressed against retaining earnings by the undistributed profits tax, business capital expenditures declined violently. Such expenditures can't be made when there is no cash, or, more literally, when cash and the current ratio are already uncomfortably low. This situation is sufficient to explain a decline of importance in business. There were other good reasons why business fell sharply this year as well, but financial developments were certainly a vital part of the cause.

Financing of business capital expenditures during the prosperous period of the preceding decade was somewhat different. The excellent figures provided by Dr. Simon Kuznets on the physical flow of durable goods for business use show that about one-half was to replace those losses arising from depreciation and depletion. There are as yet no financial figures paralleling Dr. Kuznets' compilations—that is one of the most important jobs to be done—but some fragments indicate the situation. Dr. Kuznets shows that the production of producers' durable goods, repairs and services to these, and business building construction totaled roughly \$12 billions in 1927 and 1928, and \$13 billions in 1929. Figures from *Statistics of Income* covering corporations reporting for tax purposes and therefore far less inclusive than the Kuznets' totals, show the amount reserved for depreciation and depletion at about \$4 billions each year, retained earnings of \$1.1 billions in 1927

² Moody's tabulations for 316 industrial corporations show the ratio of current assets to current liabilities, end of year:

1926—4.67	1929—4.87	1932—6.41	1935—4.80
1927—5.17	1930—5.63	1933—5.76	1936—4.27
1928—4.76	1931—6.39	1934—5.23	

and about \$2.5 billions in 1928 and 1929. New productive issues are shown by Mr. Gostomski's studies to have totaled about \$3 billions each year. Working capital rose slightly each year. These totals account for two-thirds to three-fourths of the totals Dr. Kuznets shows, and indicate a much more important contribution by the capital markets during that period than the recent one.

The railroads provide a case study of 1927-29. The gross capital expenditures of the railroads totaled \$771 millions in 1927, \$676 millions in 1928 and \$853 millions in 1929. Net proceeds from sales of securities less retirements provided about 25 per cent of this amount. In other respects the rails are hardly typical, however, in that they depreciate only equipment, but not, practically speaking, way and structures.

Still other pieces of evidence could be presented. But all the evidence is piecemeal. The job of measuring the process of financing the capital expenditures of business comprehensively and over a period of time is yet to be done. But even the piecemeal evidence appears to warrant definite, if only tentative, conclusions.

Working capital, which had reached a high level as a result of operations in earlier years, provided the major part of cash for the recovery in business capital expenditures from 1933 to mid-1937. In the 1920's the capital market was a much more important source. During 1933-37 the expansion in the supply of money was brought about chiefly by government financing, whereas in the 1920's it resulted chiefly from business borrowing. Very briefly and roughly stated these are the changes in the capital financing of business.

There can be little question that the method of financing in the recent years was economically and financially unsatisfactory, that the change was an unfavorable one. Furthermore, and this is significant, I think that we can agree that the method recently used will not be repeated. With working capital already depleted, drafts upon it to finance another sizable expansion in capital expenditures cannot occur. Nor can working capital be rapidly replenished by earnings retention with the undistributed profits tax in effect; indeed they would provide funds only slowly were the tax repealed. Bank loans do not, of course, help the working capital position. And I trust that we shall not soon see another era of large government deficits; even if that should be attempted I can see no chance of a substantial portion being monetized in view of the present capital structure position of the banks, quite regardless of the volume of excess reserves.

Therefore, a functioning capital market which will provide funds in volume to business seems to me to be a necessary condition to any

consequential improvement in business capital outlays, which means business activity, for some time to come. This does not mean that business cannot cease to decline, or that it cannot score some improvement without a new issue market. A turn can come, and some progress upward can be made. But I think the evidence is strong that this country will not see what we will agree is prosperous business for a number of years unless a good market for new capital issues is present.

Hazard capital is most especially needed.

So much for recent changes and the present situation in the capital financing of business. In closing, I would like to raise, very briefly, some longer term questions on the same subject.

Provision for physical depreciation and depletion has become the most important single item of business capital outlays. This is indicated by the Kuznets figures, and others already cited. Figures provided by Mr. Laurence Sloan and associates for 135 industrial companies for the period 1922 through 1935 suggest the same fact. Inability to provide any details of gross capital outlays in these figures is regrettable, since they cover a longer period with annual income statements and balance sheets than any other series I know. But they do show that in 10 of the 14 years depreciation and depletion exceeded retained earnings, and that amounts reserved for depreciation and depletion greatly exceeded funds obtained by sale of senior securities net, in every year; unfortunately funds obtained by sale of equities is not given.

It seems doubtful that the amounts reserved for depreciation and depletion over a longer period of several decades have accounted for so large a portion of capital outlays. In years prior to the war I feel confident that new investment of funds borrowed from the capital markets was much more important. In short, it seems probable that business is gradually increasing the proportion of capital financing done through charges to current operations, and likewise the proportion of capital assets purchased with funds provided by internal sources.

This is a trend that is logical as our total capital equipment rises and as a growing part of expenditures on it each year are accounted for by expenditures to preserve it. Established businesses should be able to finance more of their requirements internally than newer businesses. Furthermore, the diminishing rate of population growth may well result in diminishing need for additions to assets; preservation of existing plant may be the chief requirement.

If this longer trend is a fact, then over the longer future than the next few years important questions are raised as to the function and

position of the capital markets. This question is provocatively discussed by Dr. Grebler in the 1937 winter number of the *Harvard Business Review*, including the points I have mentioned, and others as well. I suspect that the capital markets will be more and more important in business finance as a mechanism to permit the refunding of maturing securities, and less and less important, over a longer period of time, as a source of new capital for business.

This possibility raises one additional question. What, then will be the outlet for individual savings, if the savings habits of this country continue?

In short, the position of the capital markets is the most significantly changing factor in the capital financing of business. In recent years its importance has abruptly declined, almost to the vanishing point. During the next few years, its importance apparently must rise if we are to have prosperity as I think we will. And over the longer term, it appears likely that the importance of the capital market as a source for new capital is gradually declining.

CHANGES IN SECONDARY DISTRIBUTION OF EQUITY SECURITIES*

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WHEN A CORPORATION or underwriting syndicate disposes of a new issue of securities we think of original or primary distribution and we speak of the security as having been marketed. But this is really just the beginning of its market career. If it is really a worthwhile security it will have a long life following primary distribution; it will change hands many times; it will know many owners. This latter part of its market life may be called secondary distribution and will never completely cease unless it is retired for one reason or another.

Secondary distribution has been taken more or less for granted and there is a scarcity of material analyzing the process. The study of United States Steel stock by the late J. Edward Meeker is perhaps the best inductive work that has been done along this line. It shows in a convincing manner the nature of the two-way market that exists in securities, i.e., how from the time of its "speculative youth" to its maturity as a seasoned security it see-saws back and forth from the hands of speculators to investors as its price rises and falls. It is reasonable to suppose that the behavior of this stock is typical of many others even though definite verification is lacking. More studies similar to this one should be made but most corporations are unable or unwilling to supply the needed figures. In fact, research in this field has scarcely been started and basic data are quite incomplete.

The number of times an issue will change hands, the kinds of owners who will possess it, the extent to which investors sell to each other, the extent they sell to speculators, why investors sell, what happens to the proceeds and other similar questions remain for exhaustive investigation to answer. At present we have only inconclusive and very partial answers to these questions.

However, we do know that most of the purchasing and selling which comprises secondary distribution occurs over-the-counter and on stock exchanges. In fact the operation of these two types of markets is virtually synonymous with secondary distribution. Recently these markets have not behaved in their accustomed manner and secondary distribution has in turn been affected. The extent of this is not fully known but we may glean a few facts from the financial characteristics

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of the operations on at least one exchange. The most important single market of secondary distribution is the New York Stock Exchange, and since data on its functioning are more complete than for other markets the following analysis and statements will relate, largely, to it.

The major changes and their accompanying problems which have developed during the last few years in the field of secondary distribution center around (1) the lack of price stability, (2) extensive price advances without the apparent aid of a large volume of credit, and (3) the interruption in the growth of the number of stockholders owning the leading American corporations.

PRICE INSTABILITY

The declining stability of prices, manifesting itself in sharp movements of prices, has attracted more attention than any other recent characteristic. The evidence of this condition is more convincing in declining than advancing markets. Moreover, lack of stability in a declining market is likely to have more serious consequences.

Most of the available proof of this instability rests on rather general tests such as the following:

A study by the New York Stock Exchange of 30 important stocks reveals a sharp decline in the volume of trading which accompanies a given decline in price. Whereas 6 years ago these 30 issues averaged a turnover of 23,100 shares when their prices declined \$1 per share in 1937 only 4,200 shares turned over with the same amount of price change. Or expressed another way: a 1 per cent price decline in 1930 was accompanied by a turnover of 13,100 shares but only 2,600 shares with a 1 per cent decline in 1937.

To see if this applied to a selected group of widely held blue-chip stocks an examination was made of the relation of price change to turnover in 7 securities (American Telephone & Telegraph, Pennsylvania Railroad, General Electric, duPont, General Motors, Westinghouse Electric, and United States Steel). The combined turnover of these stocks accompanying a 1 per cent change in price on the following days of important price declines was: October 29, 1929—21,900 shares; July 21, 1933—13,800 shares; September 10, 1937—4,100 shares; October 5, 1937—3,900 shares; October 18, 1937—2,700 shares.

The sales turnover ratios, i.e., ratio of sales to shares outstanding, for all shares listed on the New York Stock Exchange, in September, October, and November of 1929 were 12.83, 13.77, and 15.71 respectively, and involved an aggregate sales volume of 305,000,000 shares. For the same months of 1937 the turnover ratios were 2.42, 3.65, and 2.08 aggregated sales of 114,000,000 shares. It is interest-

ing to compare the change in aggregate market values for these two periods. In September, October, and November of 1929 the market lost 23 billions of value, or 26 per cent of its aggregate value at the beginning of the period. In the same months of 1937 the decline amounted to 16 billions of dollars, or 28 per cent.

In a period of 12 days of advancing prices in 1930-31 the seven widely held securities mentioned above averaged 24,200 shares of turnover when prices increased \$1 per share and in a similar period in 1937 the same amount of advance was accompanied by an average turnover of 11,700 shares. Or stated as a percentage, a 1 per cent advance in 1930-31 was accompanied by a turnover of 17,300 and in 1937 only 8,000 shares. For the same period a somewhat smaller change is shown for the group of 30 important securities that were used to test the declining market. They averaged 18,500 shares for each dollar of advance in the 1930-31 period and 10,100 for 1937. There was a 1 per cent advance for each 11,300 shares in 1930-31 and 6,900 shares in 1937. It was surprising to find the small group of high grade securities more sensitive to change than the large group.

A recent issue of *The Cleveland Trust Company Bulletin* contains a test that is irrespective of price direction. For the year 1930 for each 1,000,000 shares traded on the New York Stock Market Exchange the average net change (totals of plus and minus changes disregarding signs) was 1,610 eighths; in 1934 this reached 4,000 eighths; and in 1937 over 5,000 eighths.

Although the foregoing discussion has been described as relating to instability it also contains evidences of lack of continuity. These two conditions are not identical because instability has usually referred to the extent of a price movement in terms of time elapsed, whereas continuity has related to the amount of change that occurs between transactions. Ordinarily the latter is taken to mean that an execution is possible at the last quoted price or $\frac{1}{8}$ of a point from it. When price changes average \$1 per share on a turnover of 3, 4, or 500 shares it is obvious that many of the trades must be made at fluctuations greater than $\frac{1}{8}$ between transactions. Especially is this so if this is an average expressed in terms of the net change for the trading day, because actual trades do not always proceed in blocks of 100 shares and prices do not usually move in one direction, throughout an entire trading day. Apparently the markets lack continuity as well as stability. Even in those securities in which an average change of \$1 has an average of 800 shares of turnover, continuity may be an empty expression when on a given day in two hours' time a turnover of 8,000 shares changes price to the extent of \$10 per share.

Although this evidence of increased sensitivity may seem overwhelming it lacks the conclusiveness of case studies which would measure the deviations in terms of trend and determine the actual amount of change which has occurred between individual transactions.

The causes for such markets are not easily proved. Many persons have placed the blame on a small floating supply. Lack of data makes proof of this impossible but in United States Steel common the floating supply on March 31, 1936 was 21.75 per cent and had a continuous rise to 25.81 per cent on September 30, 1937. This is the highest percentage of floating supply this stock has had since June 30, 1927. Figures are not available, however, to prove this as typical.

Another explanation is: Antipathy toward the field of speculation generated by experiences of 1929 and the antagonistic publicity since that time may have caused a decline in speculative interest and activity. If the ignorant and uninformed members of the speculative public have been thus affected the result is salutary. It is a quite different matter if regulation has driven the informed or professional risk taker to other activities or the foreign markets. And this remark is not intended to belittle the necessity for controlling the operations of the professional group. To the extent they engage in manipulation and market mal-practices they need control. On the other hand they also perform a very real service which is frequently not recognized.

Markets exist primarily for the benefit of investors but it is impossible to have the buying and selling investor meet directly in all transactions because they are not in the market either at all times or simultaneously. Some intermediary, called a speculator takes or supplies that which an investor wants. He fills the gap, sometimes for a considerable period of time. In brief the speculator tends to balance the supply and demand between prices at which investors can be brought together. How much speculation is needed to do this is not known. The small amount of evidence at hand shows that moderate speculation tends to give the most stable prices. Extremes in either direction lead to instability. There is reason to believe that restraint of speculation may also be excessive and that speculators are not performing their usual services.

Comparative pre-regulatory figures on so-called informed trading are lacking but for the last few years we know the extent of the purchases and sales of the insiders (i.e., officers, directors, and large stockholders). Certainly during this period their trading has been relatively unimportant, in both advancing and declining markets.

Exchange member trading the last eighteen months has been so

constantly about $\frac{1}{3}$ of the total trading that it almost seems a function of volume and is not related to the nature of price movement. Presumably the ratio was larger in previous markets. In any event if the dealer function was being performed efficiently one would expect to find greater price stability. Many dealers claim they no longer step into the market as formerly and blame existing and anticipated government regulation for the change.

Higher margin requirements have no doubt been a factor in reducing the number of accounts and also the volume of trading but more complete discussion of this point is reserved until later.

Taxation is mentioned prominently as a cause, by some market commentators.

Do not construe these remarks to mean that a greater volume of speculation would have made any essential difference in the eventually attained price levels, but probably these levels would have been reached in easier stages and the uncertainty of a jittery market that could not weather shocks would not have been transmitted to the entire business community. General uncertainty of the future of business may be more important than all of the other reasons combined.

FINANCING SPECULATION

The second important change has to do with the financing of speculation. Brokers loans, volume of trading, and stock prices used to move in unison not only with reference to time but also extent; brokers loans in a rising market ranged from 8 to 10 per cent of aggregate market value. From January, 1927, to September, 1929, the market value of shares listed on the New York Stock Exchange increased 51.3 billions of dollars. In the same period brokers loans increased 5.4 billions of dollars. From April, 1935, to March, 1937, the value of listed shares increased 32 billions of dollars, and brokers loans increased only .4 billions. At first it might be supposed that the financing was done directly by the banks and did not show in brokers loans. This is not the case because total security loans of all reporting member banks increased less than 200 millions during this same period. If there is any thought that credit balances hid the real situation that is disproved by the size of customers debit balances and the decline in brokers loans in September, October, and November of 1937. Apparently an extensive price rise can take place without the direct use of any great volume of credit. No doubt the margin requirements of the Federal Reserve Board have served to restrict the known volume of credit which was used but the ability to maintain a flexibility of margins which could produce desired results has not been demonstrated. Thus in the

3-months' decline in values in the fall of 1937 a partial relaxation of credit restriction occurred only after the decline had run its course—a decline as severe in fact as that occurring in the fall of 1929. Previously it was rather generally believed that such a restriction on credit would also restrain prices. Perhaps huge idle deposits made possible a large volume of outright purchasing and this coupled with a low floating supply caused the rapid price advance. If the former were correct one would expect to see some evidence of this in an increased number of stockholders or in a marked increase in the holdings of large stockholders. Surface indications are that a large part of the trading was just a milling around, perhaps one group of investors selling to another without much aid from speculators. However, the information which would answer these questions definitely is not available. Brokers do not segregate customers accounts according to outright and margin transactions. Most corporations do not furnish adequate and prompt information on the changes in their stockholders nor do they classify them by groups according to the extent of holdings. Floating supply figures are available continuously for only one important corporation. More definite analysis of the problems herein suggested await the collection of these additional data.

Before proceeding to the third important change attention should be called to the less rigorous control of credit used for primary than for secondary distribution.

Under the Federal Reserve Board's Regulation U, Section 2, an exception to the loan requirements on security collateral is granted on "any loan to a dealer or two or more dealers to aid in the financing of the distribution of securities to customers not through the medium of a national securities exchange." This has enabled syndicates floating new issues to borrow a higher percentage of sale price than is permitted on seasoned securities.

The distinction between credit for new issues and credit to carry old ones could not rest on grounds of the doubtful value of the collateral therefore it presumably is a policy which makes it more appropriate to use credit to aid new flotations than to carry old ones. The justification for this would be clear if securities were like consumption goods and moved in a one-way market, i.e., if when sold to an investor they would never come back on the market. But all past issues except those of defunct companies are still in existence and constitute actual or potential market supply. Owners wish to sell from time to time to obtain cash, to shift from one security to another and for a multitude of other reasons. Whatever the reason for the sale we cannot very well decree that once you have purchased a security you dare not sell it.

Unless credit is allowed to facilitate this sale or exchange of securities capital cannot flow freely.

DECLINE IN NUMBER OF STOCKHOLDERS

The third important change in secondary distribution is the interruption in the upward trend of the number of stockholders. From the first quarter of 1929 to the first quarter of 1933 common stockholders in 50 leading corporations increased from 1,626,000 to 3,500,000. Every succeeding quarter was higher than the one which preceded. After the first quarter of 1933 the figure started to decline and at the beginning of 1937 had declined 100,000. A check was made of the same 7 widely held securities used to test instability. Their stockholders increased from 888,000 in the first quarter of 1929 to 1,756,000 in the first quarter of 1933. Since that time they have declined to 1,648,000¹ in the third quarter of 1937. This is a decline of 6.3 per cent and is much more severe than for the group of 50 stocks.

Further evidence of this condition is found in two surveys of stockholders: one for 1935 comprising 175 corporations and the other for 1936 covering 180 corporations. Both studies show declines although they are small.

A partial explanation for the decline in stockholders is to be found in a characteristic of an advancing market. Outright owners sell to margin buyers during periods of advancing prices and increase their holdings when prices decline. This process normally causes stock to concentrate in the names of brokers as prices rise. Conversely, the number of stockholders increases as prices decline and stock is being transferred from the names of brokers to individuals. However, the relatively small debit balances on brokers' books during the period under discussion indicate that the quantity of stock remaining in brokers' names to be transferred when the accounts were closed could not have been large. More interesting is the fact that the decline occurred during a period when the common stock was much publicized as a hedge against inflation and it would seem logical to expect persons to hedge in the time-tested equities. Perhaps the samples studied were inadequate if many persons were buying stock indirectly, especially through investment trusts. Data are not available to answer this.

There is yet another possibility. If the floating supply of well seasoned securities was in such demand that investors believed that small purchases of such securities sent their prices too high they might have placed their funds in less widely held securities. The fact that

¹ This is practically the same aggregate figure as that which existed at the end of 1936 although the stockholders declined a trifle in some corporations and advanced in others.

stockholders declined in 175 corporations in 1935 and in 180 corporations in 1936 would seem to discredit this thought.

Assuming that it is possible to prove conclusively that a decline occurred in the number of stockholders several interesting collateral questions might be raised at this point: why did investors sell? And what did they do with the proceeds?

Possible answers to these questions: a market rise gave them a profit and some of them wished to convert this to cash. Or they may have wanted to transfer their ownership to some other species of property. Possibly some of it went into consumption goods—(during 1935–36 this must have been by choice and not necessity). Or possibly it went into producers goods. However, it is not likely that it went into mortgages, and new issues of corporate securities (other than refunding) were small. We shall have to look elsewhere. The growth of bank deposits and government bond issues suggests that it found lodging places in these two items. In other words it was an attempt to increase the liquidity of assets. If the security markets had been functioning more perfectly the desired liquidity might have existed in corporate securities although the fright of small capital may be attributed to many other factors.

SIGNIFICANCE OF CHANGES

Regardless of the causes of the current financial tendencies in the secondary distribution markets and their immediate market importance they have very significant and far-reaching effects on our national economy. If security markets functioned ideally they would provide correct evaluation of securities, give us ready marketability, and direct the flow of capital intelligently. None of these functions has ever been performed perfectly, and now there is evidence that in recent years their efficiency has actually declined. When a turnover volume from a few hundred to a few thousand shares of the stock of large and widely held corporations is accompanied by a change of \$1 to \$9 per share within a trading day, we can scarcely claim correct evaluation. This is more fully realized if we multiply these price changes by the number of shares outstanding. By no stretch of the imagination can we believe that the stock of a given corporation is worth 310 millions at 10 A.M. on Wednesday, worth 285 millions at 3 P.M. the same day, and worth 300 millions at 11 A.M. the following day.

Marketability implies ability to find a buyer at a price reasonably close to the last quotation. With the present instability of prices, the closing quotation is no indication of the price you will receive if you

attempt to sell the following morning. This uncertainty has been a growing one. It used to be said that we had continuity at the expense of stability. Now we have neither.

The intelligent flow of capital is predicated on the assumption that the price of a security in relation to its earnings will serve to attract or repel new capital. Unfortunately this function is dependent on correct evaluation. In its absence it is impossible to have a proper direction of the flow of capital. Nor is this all. It appears that capital is not flowing through the secondary markets in its customary manner. New capital flotations to finance private industry are facilitated when outstanding issues are absorbed by the general public. This absorption is usually evidenced by an increase in the number of stockholders. As the seasoning process progresses more small investors become stockholders and release the funds of former holders. The funds so released are available for investment in other securities, especially those of new flotations. The decline in the number of stockholders in seasoned securities is an obstacle to this performance.

Moreover, the decline in absolute number of stockholders is an indication of another very important development—namely, a lowered proportion of national savings is going into private securities. I believe complete inquiry into the questions previously mentioned: why do investors sell and how do they use their proceeds, is justified in order to reveal the way capital flows via secondary distribution and to discover the impediments to this flow.

Another less important but nevertheless interesting result is the tendency for trading on exchanges to decline relative to the total stock trading.

Many market experts have generally assumed that it was beneficial to the investors to have the transactions in their securities occur on organized exchanges where the actions of brokers could be more easily supervised and quotations could be given prompt publicity. If there is validity to the claim that the uncertainty of exchange prices has lead purchasers and sellers of large blocks of stock to make their commitments privately and over the counter there is reason to believe that the trading trend is away from centralized markets. It is impossible to obtain the over-the-counter figures because there is no centralized agency which assembles the volume and price at which transactions are made. However it is possible to make an estimate of the New York State Transfer Taxes derived from New York Stock Exchange and New York Curb Exchange transactions and compare this with the total transfer tax revenue received by New York State. A calculation of this

kind reveals that for the first 10 months of 1937 each of the Exchanges gave rise to a smaller proportion of the total revenue than it did in 1936.

In conclusion let me say this paper is intended to be suggestive rather than conclusive.

I think all will agree there is substantial evidence that the delicately adjusted market mechanism through which secondary distribution takes place has undergone considerable change and is not performing efficiently. To what extent these changes are symptoms of a common basic cause; to what extent they are the result of the market's inherent weaknesses, characteristics and interactions; to what extent they are interfering with the normal functioning of the economic machine, are questions which can not be satisfactorily answered without very extensive, intensive and expensive research. But these questions certainly merit attention at a time when there is an earnest effort being made to stimulate the flow of capital; every possible cause of the present blockade in this flow should be carefully examined.

CHANGED CONDITIONS IN THE MARKETING OF NEW ISSUES*

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SECURITY MARKETING procedure in the United States has gone through a process of continuous change during the past century and longer. While the year 1933 doubtless marked the end of an era in the history of American investment banking, that era of itself had not been of long duration. It began with the World War period.

The causes of the sharp decline in the volume of new financing in recent years can be understood only after reference to these broad changes over the longer period.

SECURITY MARKETING BEFORE 1933

Four major epochs in the evolution of security marketing methods may be distinguished before 1933.

The first lasted from the early days of the Republic down to the Civil War. During this early period, the investment banking machinery of the country played but a modest role in bringing together issuers of securities and those who wished to invest in them. In fact, the "private flotation," or direct sale by issuer to investor without the mediation of an investment banker, except perhaps as an agent to facilitate the negotiations, was the rule.

Issuers were relatively few in number. The investing public consisted of a very limited number of financial institutions and wealthier individuals. There was no need for an elaborate machinery, under such circumstances, to bring together those who wished to raise long-term capital in substantial amounts, and those who desired to invest their surplus funds at long term.

The second era in the evolution of security marketing in America was ushered in by the Civil War. Cut off from foreign sources of capital, because its cause was unpopular in Europe, the Union government had to cultivate the domestic capital market very intensively to raise the sums, vast for those days, needed to carry on the war with the seceding states. This task was consummated successfully, with the help of greenback inflation, under the leadership of Jay Cooke, who formed a syndicate of investment houses which placed a total of some two billions of dollars of Federal government bonds. The investment banking machinery thus developed was turned to the flotation of large issues of railroad mortgage bonds, such as those of the Northern

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Pacific and Chesapeake and Ohio, after the war was ended. The panic of 1873, involving the collapse of many of these investment houses and of the railroads they financed, brought this first epoch of large-scale popular security distribution to an abrupt halt.

The third phase of investment banking evolution was marked by a narrowing of the American capital market. Individual investors largely turned to direct investments in business enterprises or real estate, or utilized the banks and insurance companies as investing institutions. The large distribution houses which dominated the investment banking business in the Civil War era gave way to the international banking houses whose strength lay in their ready access to rich foreign capital markets in Great Britain, Holland, and the Rhineland, and in their close connections with domestic investing institutions. During this period, the emphasis in the distribution of securities was shifted from retail selling, the chief function of the syndicates of the Civil War days, to underwriting or wholesaling.

The World War witnessed the inauguration of a fourth phase of investment banking evolution which lasted down to 1933. In many respects, this era resembled that of the Civil War. Once again, the government had to raise vast sums to finance a war, and perforce cultivated the domestic capital market to obtain the necessary funds. Bank credit inflation vastly facilitated the operation. Once again, persons newly accustomed to the purchase of bonds, as a result of an intense patriotic appeal to buy Treasury issues, subsequently bought other bonds as well under the pressure of aggressive salesmanship. In the twenties, vast distribution syndicates, numbering up to a thousand individual houses, were organized to sell, chiefly to individual investors, numerous issues of bonds of railroad, utility, industrial, real estate, and foreign issuers.

Since recent changes in security marketing practice are of significance chiefly with relation to this post-war period, we may summarize the latter's major characteristics as follows:

1. The emphasis upon the use of many thousands of security salesmen, who utilized a highly aggressive and personal technique in the sale of securities.

2. Speed was of the essence in the security distribution process, since underwriter and retailer both sought to avoid as far as feasible the risk of adverse price movements, regarding their function almost entirely as one of distribution rather than risk bearing. Often, distribution to the public began on the day when the purchase contract with the issuer was signed by the underwriters.

3. Keen competition among the numerous underwriting and distribution houses of the day made for a narrowing of the spread between

the price received by the issuer and that paid for the issue by the investing public. This price spread appeared particularly narrow when considered in relation to the low average quality of the issues floated.

4. While institutional selling was important, sales to individual investors were emphasized. In fact, the investment banking machinery during the twenties was geared mainly to serve individual, rather than institutional, buyers.

THE EFFECTS OF THE 1933 ACT

The enactment of the Securities Act of 1933 effected a number of basic changes in the investment banking business. Security selling was not subjected to specific statutory regulation until 1909. Since then, the states have enacted blue sky laws, mostly of limited scope. The innovation of a Federal law to regulate the origination and distribution of new security issues, and the changes thus brought about, would have alone sufficed to mark the inauguration of a new epoch in the evolution of the nation's investment banking business. Let us examine the changes wrought by this statute, therefore, leaving for later consideration the other forces which, in the writer's opinion, were far more important in bringing about the virtual revolution that has occurred during the past few years in the process of marketing new security issues in this country.

Underwriting has now become a far more specialized and hazardous function, as a result of the 20-day waiting period provided in the Act and the liabilities imposed by it. For at least 20 days after a registration statement for a new security issue has been filed with the Securities and Exchange Commission, no sale may be made by the underwriter. It is true that the purchase contract between the issuer and the underwriters may not go into effect until near the end of this 20-day period, and that often, but by no means always, a hedge clause may permit the underwriter to withdraw from his commitment before selling begins because of adverse market or other conditions. Yet underwriters are usually compelled to carry an issue for days or even weeks, where formerly they sought to pass on the issue to a banking group or distribution syndicate on the day when they signed the contract with the issuer, or very shortly thereafter.

The amendments to the Securities Act passed in 1934 greatly diminished the gravity of the civil liabilities assumed by underwriters and dealers for misstatements or omissions of material facts in a registration statement or prospectus. Civil suits must be brought within three years after an issue has been offered to the public. Usually a new security offering will not suffer a major decline in price during this initial period, so that there will not be much incentive for initiating litigation. Nevertheless, the possibility of such suits is an added reason

why organizations with small capital and limited ability to withstand litigation refrain from entering the underwriting business.

Since the original underwriters must bear the risk up to the time the registration statement becomes effective, there is no longer an incentive to share the profits of underwriting with other groups. Hence, the intermediate underwriting or "banking" groups common during the twenties, and the underwriting syndicates which both underwrote and sold, have disappeared. The process of security origination and distribution, as a result, has been very much simplified. In practically every case of a new security issue now, there is a purchase group of a few large underwriting houses who sign the purchase contract with the issuer, dividing the liability in fixed proportions among themselves, and a far larger selling group which does no underwriting, the members receiving a substantial selling commission only for securities actually sold by them.

The requirements of the Securities Act naturally increase the costs of flotation of new security issues. However, the available statistical evidence fails to show that this is of a burdensome character, except for quite small issues. On 120 bond issues registered with the Securities and Exchange Commission during 1936, the commission and discount averaged 2.2 per cent of the amount of the offering, and the other expenses 0.7 per cent. On 8 issues of less than \$250,000 each, however, the commissions and discounts were 6.6 per cent, and the other expenses 1.7 per cent.

The burden of expense is naturally far greater in the case of common stock issues. On 120 common stock issues floated during 1936, the average commission and discount was 16.5 per cent of the amount of the issue, and the other expenses 1.3 per cent. On 32 stock issues of less than \$250,000 each, commission and discount were 20 per cent and other expenses 2 per cent.

In the above compilation, prepared by the Securities and Exchange Commission, a large part, but not all, of the "other expenses" are attributable to the Securities Act of 1933, particularly in connection with the preparation of the registration statement and pertinent exhibits. Doubtless, the underwriting spreads in many cases are higher than was the case for similar issues in the past because of the added liabilities involved, although the lack of adequate comparative data on spreads for most types of issues and the many other factors that affect the profit margin of investment bankers make an exact statement on this point impossible.

Issuers who find the Securities Act of 1933 burdensome and enjoy a strong credit standing can always circumvent the statute through effecting a private offering to a few large institutional investors. The

number of such private offerings has doubtless increased during the past few years. It would be unwise, however, to ascribe this entirely to the existence of the Securities Act of 1933. The change in the character of the capital market due to other influences, discussed at length below, is at least equally responsible for the increased popularity of direct sales of new security flotations by issuers to a limited number of large institutional investors.

One anomalous effect of the enactment of the Securities Act of 1933 has been a reduction of the amount of information that many individual investors obtain concerning a new security offering before purchase. Formerly, dealers felt free to include any data they regarded as pertinent in offering advertisements and circulars. While in numerous instances these circulars were far from exemplary in fullness or pertinence of the information presented, nevertheless they were often of great help to the layman in his appraisal of the nature and quality of the issue.

The prospectus issued under the Securities Act of 1933, on the other hand, is now a bulky and unattractive document containing far too much technical verbiage inserted merely to conform to the regulations of the Securities and Exchange Commission. Newspaper advertisements, on the other hand, tend to be limited to a mere statement of the bald facts of offering.

The Securities and Exchange Commission is expected soon to issue more flexible regulations that would permit a return to the more informative type of newspaper advertisement and the less technical form of offering circular formerly in use. Such regulations may help correct one of the unsatisfactory results of the functioning of the Securities Act, although the question of liability will still make for greater hesitancy in drafting selling literature.

CHANGES IN THE INVESTMENT BANKING MACHINERY

Profound changes have taken place in the structure of the American investment banking business since 1933, as the result both of the enactment of Federal regulatory legislation and other contemporary influences. These structural changes in turn exercise an important influence upon the ability of investment bankers to distribute a large volume of new security issues efficiently and cheaply.

The chief change has been a very sharp reduction in the number of strong underwriting organizations able and willing to handle the marketing of large security flotations. Many factors account for this. The more important have been:

1. Every major deflation period takes its toll of investment banking houses, owing to the large size of the risks that must be assumed by

such organizations in comparison to their capital, and the fact that a particularly unsuccessful underwriting impairs the standing of the house in the financial community, at least for a while. Hence, the depression of itself was the cause of considerable mortality among investment houses.

2. The Banking Act of 1933 eliminated bank security affiliates, which in 1930 were responsible for more than half the new public flotations.

3. The Banking Act of 1933 compelled private bankers to choose whether they preferred to remain in the private banking business or the security business, but they were not permitted to combine the two. The leading investment banking house, J. P. Morgan and Company, had been a private banker also, and preferred to remain such. It is true that new organizations have been formed, such as Morgan Stanley and Company, Inc., to take the place of these private bankers who have withdrawn from the issue business, but such successor organizations have been far smaller in size and have had only a fraction of the capital resources of their predecessors.

4. The facts that a protracted period of reduced activity has occurred in the capital market and that individual investors have so largely declined in importance as purchasers of new securities have led to a marked contraction in the investment banking machinery. This development has been very similar to that which came after the panic of 1873, which also brought to a close an era of widespread individual investment in new securities and was followed by a period when institutional and foreign buyers became predominant. The result has been not only a contraction in the number of active investment banking organizations, but a great decline in their average size.

This severe contraction in the number and average size of investment banking houses will probably persist for a long time. In the first place, it will be difficult to raise new capital to finance the business. Before 1933, only limited information was available about the capital resources of investment houses. It is known, however, that the security affiliates of the larger commercial banks had capital, surplus, and undivided profits of \$30,000,000 and more in many cases before 1930, while private investment banking houses in several instances had similar resources running well above \$50,000,000. Today, we find the head of one of the largest underwriting houses, The First Boston Corporation, stating that capital resources of some \$13,000,000 would be fully adequate to finance the manifold activities of this organization, and that earnings beyond that sum would be distributed as dividends. Morgan Stanley and Company, Inc., was organized with an initial capital of \$7,500,000. The large size of the liabilities incurred may be

seen from the fact that during the first half of 1937 Morgan Stanley and Company, Inc., entered into \$92,420,000 of purchase group participations, while The First Boston Corporation, which stood second in this respect among investment houses during that period, assumed \$77,163,000 of such participations.

There is no reason to believe that large amounts of additional capital will be readily forthcoming to finance the conduct of the investment banking business under prevailing conditions. It is apparent that the large size of the risks involved is being better appreciated. The fall in bond prices during the spring of 1937 occasioned severe losses to some houses, and the further drop in security quotations in the fall of the year imposed additional large losses upon underwriters. In the case of the one leading underwriter whose own stock is traded publicly, The First Boston Corporation, the shares are currently quoted well below the price at which they were originally offered.

For some time to come, therefore, the number and the average size of the organizations devoted to the origination and distribution of securities are likely to be much reduced by comparison with the post-war decade. Were a broad popular demand for new issues of investment securities to develop once again, however, so that the investment banking business would become as profitable as it has been in past periods of active flotations of new issues, existing organizations could be expanded and new houses would again enter the field, so as to meet the enlarged demands made upon them. The fact that a number of larger brokerage houses and investment trusts could, under existing restrictions, readily enter the underwriting business would facilitate such an expansion of the machinery in response to a favorable turn in conditions affecting the security business.

However, serious consideration might well be given to a relaxation of existing legal restrictions on underwriting by banks and insurance companies, to expand the machinery available for this purpose.

The contraction in the number and average size of retail security distribution organizations during the past few years has been fully comparable with that which has taken place in the underwriting field. Retailers who specialized in sales of bonds to individual investors particularly have had to effect a sharp shrinkage in their organizations. Many such organizations have revised their business to serve financial institutions that now constitute the backbone of the demand for bonds. In general, this change in clientele has necessitated a notable increase in the relative size of the personnel devoted by the average retailer to analytical and statistical work, and a contraction in the sales forces maintained.

Also, the factors making underwriting a more highly specialized

function, discussed above, have tended to bring about automatically a far sharper segregation of the underwriting from the retailing function than existed in the past. In this respect, the organization of the investment banking business in the United States has come to resemble that which prevails in Great Britain, where such separation of function among individual organizations exists to a large degree, far more closely than was the case a decade ago.

OTHER MAJOR FACTORS

Attention has been paid hitherto chiefly to the Securities Act of 1933 and, to a far lesser extent, the Banking Act of 1933 as causes of the changes in the marketing of new security issues that have occurred. But it is easy to exaggerate the effects of these statutes. A number of other and, in the aggregate, much more important influences have been at work.

The years 1928 and 1929 were abnormal as far as new financing was concerned, because the great boom on the stock exchange made new stock issues unusually saleable. For the eight year period 1920-27, new bond issues averaged \$3,110,000,000, apart from Federal, State and municipal flotations. By contrast, in the four-year period 1934-37, with the year 1937 partly estimated, new bond issues aside from Federal, State and municipal offerings averaged \$1,680,000,000, a decline of 46 per cent.

This sharp decline in the volume of new bond financing does not tell the whole story. During the twenties, the larger portion of the new offerings were classifiable, at the time of sale, as "middle grade" in quality. Put differently, we might say that probably the larger portion of the offerings were or would now be rated, at the date of issue, Baa or lower. By contrast, in the 1934-37 period, the larger part of the new flotations consisted of high grade issues rated A or better at the time of sale. In fact, the refunding of gilt-edged bond issues into lower-coupon offerings accounted for the largest part of new corporate issue activity in those years.

This fundamental change in the nature of the type of security that is being offered is attributable, in the first place, to the withdrawal of individual investors, by and large, from the bond market. This, in turn, has been due to a number of factors, the more important of which have been:

1. The severity of the depression of the early thirties, and the extensive character of forced liquidation of securities in the 1930-33 period. Middle grade bonds during this period suffered pricewise, by and large, almost as much as stocks. The prestige of the bond as a more conservative medium of investment was thus severely shaken and the rank

and file of individual investors could be expected to return to bond investment only after a period of readjustment in which bond prices would display an extended record of relative stability. The new severe decline in prices of numerous middle-grade bonds recently tends to prolong this period of transition indefinitely.

2. The poor average quality of the bonds sold in the twenties, which helps explain the bad price performance of these securities. American investment houses, spurred by the severe competition and the "New Era" psychology of the late twenties, promoted the sale of very many poorly secured, low grade, real estate, investment trust, foreign government and other issues that proved extremely vulnerable to adverse developments. Probably not since the earlier railroad promotion booms were so many poor securities floated under the guise of conservative investments in so short a period.

3. A very large proportion of the middle grade bonds outstanding consists of railroad and public utility issues. Both these industries have been subject to special unfavorable influences since 1929. The railroads have suffered from large-scale diversion of passenger and freight traffic to other transportation agencies, rigidity of wage costs and an excessive load of funded debt acquired in the past when railroad bonds were very readily saleable. In addition, enactment of Section 77 of the Bankruptcy Act provided a new and untried statutory procedure which has held up indefinitely the reorganization of weak roads.

In the case of public utilities, some holding company issues have been affected adversely by the enactment of the Public Utility Holding Company Act. Certain operating company bonds also have been affected by the Administration's program of government competition in the power business.

Since railroad and public utility bonds loom large in the portfolios of many individual investors in bonds, the poor performance of numerous such issues has acted to discourage additional investment in bonds generally.

4. The effort to spur economic recovery through monetary manipulation and widespread vague popular fears of "inflation" in 1933 and thereafter served to scare many individual investors from buying fixed income securities, causing them to turn to common stocks or merely to leave their surplus funds on deposit in banks instead.

5. The extreme easy money policy of the past few years has tended to drive down sharply the yields of the highest grades of bonds as financial institutions, particularly banks and insurance companies, have sought to obtain desired investments from the limited available supply. As a result, individual investors, accustomed to 5 and 6 per cent yields or more from their bonds, have had little incentive to

purchase these high grade new issues. It is true that very much higher yields have been available on poorer quality bonds, but the mortality among obligations in this category has been so high, as we have seen, that the rank and file of individual investors, who made up the backbone of the market for new bond flotations in the twenties, generally have refrained from purchasing them.

The above factors explain why individual investors can be expected to return only gradually to the market for new security issues. Also, they indicate that, for a time at least until confidence among them has been more fully restored, they will find acceptable only considerably higher quality bonds than were sold during the twenties. Securities which investors will buy after a major deflation period, such as that of 1930-33, must be of higher grade than those they purchased during an extended period of prosperity.

As long as the volume of high grade bond offerings remains restricted and middle-grade bond issues remain difficult to sell, we may expect to see the present pattern maintained in the investment banking business. A handful of organizations of limited capital facilities will suffice to carry on underwriting, chiefly of quite high grade bond offerings designed for sale to financial institutions. A larger number of retail distributing organizations with comparatively restricted staffs will be concerned with ultimate distribution of these issues, chiefly to institutions. Private flotations may gain in relative importance, since a handful of large financial institutions constitute so large a portion of the available market for new issues.

The investment banking machinery, as thus constituted, is far less effective than it was in the twenties as an agency for raising long-term capital in adequate volume at moderate cost for larger enterprises. It serves a much smaller segment of American industry. It will provide acceptable investment securities to absorb surplus funds to a far less numerous investing public.

The impetus for a renewed expansion of this machinery will probably have to come first from issuers of securities, who do not feel they now have sufficient incentive to bid for capital in the market on terms that would attract the rank and file of individual investors. Whenever the supply of acceptable offerings increases sufficiently, both the investment banking machinery and the number of prospective buyers will in all probability expand sufficiently to absorb them without difficulty.

THE SUPPLY OF NEW ISSUES

The above factors explain why individual investors, by and large, have played a greatly reduced role in the market for new security

issues. The field has been left largely to institutional investors, who have been ready to absorb the bulk of the new bonds now being offered on a very low yield basis.

However, the aggressive easy money policy of the Federal Reserve System could not have depressed the level of yields on high grade bonds if the demand for long-term capital on the part of corporate issuers were more nearly comparable to what it was during the twenties. Low prevailing yields on good bonds discourage individual investors from buying bonds, but it is important to remember that these low yields in turn reflect the greatly restricted demand for new capital. Were corporations whose credit standing is strong more eager to raise new capital, the supply of long-term, high grade bonds would soon largely exceed the demand from financial institutions for long-term issues. Then yields would have to rise, in order to attract the individual investor back into the market, regardless of the existence of excess bank reserves and easy money market conditions.

Experience indicates that individual investors will buy corporate bonds of satisfactory grade freely if they yield about 2 per cent more than do Government obligations. At least, that was true during the decade of the twenties. Hence, with Government bonds selling to yield about 3 per cent, the individual investor could be expected to re-enter the market for new bonds in large numbers when acceptable issues yield about 2 per cent more. Under present conditions, we may say, what investors in this country crave is a good 5 per cent bond.

Business managements, aware of depression experience, have generally become averse to increasing their bonded debt. They are also very hesitant about embarking upon long-range capital expansion programs which will involve new financing on a large scale. Hence, low and declining yields on high-grade bonds reflect a deficiency in the supply of such issues, and the existence of a demand that exceeds the current supply.

If leading steel, petroleum, automobile, chemical, and mail order concerns were as ready to incur funded debt as railroads and public utilities were in the past, there is little reason to doubt that individual investors would now buy their bonds, if available on a yield basis of about 5 per cent, as freely as rail and utility obligations were purchased in the past. Whenever such a development occurs, the investment banking machinery would doubtless be expanded to take care of it.

TENDENCIES IN CONSUMER FINANCING*

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FOR PURPOSES of this discussion, the term "consumer credit" will be used to mean the sum of the accounts receivable of retail merchants, doctors, dentists, public utilities, and others who sell goods or render services to the consumer on a credit basis; the outstanding receivables of instalment finance companies; and the loan balances of lending agencies which deal primarily with consumers. It excludes loans against life insurance policies, savings bank passbooks, and the shares of building and loan associations which represent in varying degrees withdrawals of savings rather than loans. Real estate loans, which resemble other forms of consumer credit in some respects, are excluded because they involve special problems of interpretation. Loans between relatives and friends are also excluded because it is impossible to deal with them statistically.

I am aware that there are those who define consumer credit as synonymous with retail instalment credit. But such a narrow definition leads to unfortunate consequences. There is no functional difference between open-account credit and instalment credit, and a cash loan is frequently an alternative means of accomplishing a credit purchase. Moreover, a considerable part of the initial obligations created by credit purchases are refinanced by cash-lending agencies. All consumer debt grows directly or indirectly out of the sale of goods and services, and this gives an essential unity to the whole field.

This paper will deal principally with tendencies in the field of consumer credit during the last three years. But in order to provide perspective for the examination of recent trends, it seems desirable to review very briefly the development over a longer period of time.

Consumer credit is not a new phenomenon. The sale of goods on credit is as old as the process of exchange, and many present techniques of consumer financing may be traced to earlier centuries, if not to earlier civilizations. Yet when we discuss consumer credit today, it is obvious that we are dealing with an institution whose most significant features are of recent origin. These new features result from qualitative and quantitative rather than from functional changes. Among them are (1) the widespread use of consumer credit, (2) the increased amount of individual commitments in relation to incomes. (3) the use of powerful collection instruments as security, and (4) the development of a variety of specialized consumer credit agencies.

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These characteristics began to develop after the Civil War. First, the instalment system, which had been used successfully as early as 1850 for sales of sewing machines, was applied on a large scale to sales of furniture and other household equipment. A few years later came the growth of a business which lent small sums to wage-earners at very high rates of interest. It was not until around 1910, however, that the institutions of consumer credit began to attain their present form. The first credit union was organized in 1909, and the first Morris Plan Bank in 1910. A year later, Massachusetts enacted the first comprehensive small loan law; and by 1914 several enterprises had begun to acquire the characteristics of a modern instalment finance company. Informal advances by suppliers of goods and services continue to form the bulk of consumer credit. But even these relationships have been materially influenced by the techniques of the specialized agencies, and the modern era of consumer credit may be said to begin with their development.

Looking at the development of consumer credit as a whole, there appears to have been a gradual growth from the close of the Civil War to 1922, followed by a very rapid expansion up to 1929. In spite of the fact that the Russell Sage Foundation has been working for almost three years on a study of the quantitative aspects of consumer credit, it is still impossible to describe this growth in precise figures. Our data for the period before 1923 are fragmentary and even for later years only crude estimates can be made. Preliminary calculations, upon which we expect to improve very shortly, indicate that the amount of consumer credit approximated \$4½ billion at the close of 1923 and reached a sum of about \$11 billion at the close of 1929. All types of consumer credit contributed to the expansion during this six-year period, but the most striking increases occurred in the receivables of the new specialized agencies.

Why did this expansion occur? In the first place, certain general social and economic developments furnished the necessary conditions for expansion. Perhaps the most important was the rise of real incomes of the rank and file of the population, which tended to create family credit capacities by providing increasing margins above costs of subsistence. Associated with the rise of real incomes was the change in the characteristics of consumers' disbursements. Large expenditures for durable equipment had crept into family budgets, which not long before had been devoted principally to food, housing, and clothing. These new items were readily adaptable to credit merchandising. Other factors were the growth of cities, the growth in the number of wage-earners, and migrations to new industrial centers. Their effect

was to substitute the anonymity of city life for the mutuality of the "home" town, competitive standards of living for traditions of thrift, and complete dependence upon the market for a high degree of self-sufficiency with respect to the means of subsistence.

The stimulating factors, however, must be sought in the motivations of the parties to individual contracts. The most powerful influence toward expansion was the competitive pressure to sell merchandise. Credit was found to be an aid to sales. Hence, when one merchant offered credit terms, others were forced to follow. This pressure applied not only within the same field of merchandising, but between types of merchandise. Industries whose products were readily adaptable to credit sales increased their share of the consumer's dollar. Trade associations of competing industries explored ways and means of keeping their place in the sun, and frequently found them in devices for credit selling.

To permit this expansion of consumer credit, however, the consumer had to be willing to increase his commitments. The phenomenon of increasing indebtedness was described by some writers as an irresponsible plunge of the American family into debt. But I do not believe that such an interpretation is tenable. The great majority of people used credit thoughtfully with a weather eye to their solvency and ability to pay. *The increase in consumer debt could not have occurred on such a scale if initial credit commitments had conflicted with the accepted standards of family budgeting.* The consumer was acquiring durable goods, and the "pay as you ride" slogan had sunk deep into his consciousness. From his point of view, he had committed himself only to spend \$10, \$20, or \$40 a month for the current use of a radio, or a washing machine, or an automobile; he was expanding both sides of his balance sheet—not going into debt. It is true, of course, that some consumers were irresponsible, that others exercised bad judgment, and that still others had their reasonable expectations upset by circumstances beyond their control. Because many contracts had to be refinanced over longer periods of time, consumer debt as a whole tended to increase more rapidly than initial credit commitments.

The expansion ended with the stock market collapse, or shortly thereafter. For retail merchandise credit, liquidation appears to have begun promptly; for industrial banks, credit unions, and pawnbrokers, it was deferred for almost a year; and for small loan companies, it was apparently delayed until early in 1931. There were also area differentials. Liquidation began more promptly in the industrial cities of the east and middle west than in the south and far west. The rate of liquidation was related to the former rate of expansion. In Detroit, Cleveland, and Chicago, where the expansion had been rapid, the

contraction was precipitate. But in Boston, Providence, and Philadelphia, where the boom had been tempered by economic handicaps, liquidation was more gradual. By the close of 1933, the outstanding amount of consumer credit had been reduced to about half of its 1929 level—roughly to \$6 billion.

The completion of the liquidation, like the end of the expansion, occurred at different times in different areas and for different types of credit. The liquidation of retail merchandise credit was stopped abruptly by the revival of credit purchases in anticipation of higher prices in the early summer of 1933. The low point in the loan balances of endorsed-note agencies appears to have occurred somewhat later, probably in the spring of 1934. For small loan companies and pawnbrokers, the upswing was still further delayed. The low point for some areas appears to have occurred as late as the winter of 1935.

For consumer credit as a whole, the expansion got under way in the spring of 1934. The rate of expansion was slow at first, then increasingly rapid. The increase for the year 1936 seems to have been somewhere in the neighborhood of \$2 billion, which probably exceeds the expansion of any previous year. This increase is the more remarkable because about one-fourth of the bonus payment appears to have been used by its recipients to liquidate consumer credit commitments. An even greater rate of expansion prevailed during the first half of 1937.

The recent expansion has taken place on several fronts. First, there has been an extension of the geographic frontier. In spite of intense competition in some areas in 1929, there were other areas in which specialized consumer credit agencies had not developed. The cyclical contraction between 1929 and 1933 encouraged the search for new markets in unexploited areas. Instalment finance companies and small loan companies opened branch offices in underserved trading centers of the west and south. When the upswing began, expansion was exceedingly rapid in these areas. I am told that the small loan business in California has an atmosphere reminiscent of the Hollywood boom. Our own explorations indicate an enormous growth throughout the west in the number of places where one can borrow money or finance a credit sale.

Second, there has been a rapid growth of several credit institutions which were relatively undeveloped in 1929. Credit unions and personal loan departments of commercial banks have tripled their 1929 loan balance. Both types of institutions found their most fertile soil in unexploited areas such as California, Texas, and Washington. But they have also grown rapidly in areas where similar facilities were already well developed. Witness, for instance, the growth of credit unions in Ohio and Pennsylvania, and of personal loan departments

in New York, Massachusetts, and Virginia. The development of new credit facilities tends in itself to tap new sources of demand. It is remarkable that personal loan departments in New York City have been able to add some \$30 million to their loan balance since 1928 without preventing an equally dramatic growth in the loan balances of small loan companies, and without materially reducing the outstandings of credit unions and industrial banks in the same area.

Third, credit merchandising has been extended to new types of goods and services. Electric refrigerators, which have been introduced to the mass market during the last few years, have been sold largely on credit terms. Home motion picture apparatus, sea cruises, the winter's coal supply, and fire insurance have recently been added to the area of instalment financing. Federal insurance of FHA contracts has stimulated the use of credit terms for home repairs and for heating and plumbing installations. Merchants who formerly shunned instalment terms have completely revised their policies, and quality stores have moved into the field of the so-called "borax houses" by selling "soft" merchandise on instalment schedules.

Still other means of attracting new credit applicants have been found. Delayed repayment schedules have been developed to appeal to certain types of borrowers. Types of security that created sales resistance have been discarded. The chattel mortgage or the wage assignment or both have been waived in many instances by small loan companies. The requirement of endorsements has been eliminated for certain types of loans by industrial banks, credit unions, and personal loan departments, and in many areas loans have been offered to persons of stable employment without any security whatsoever. A very important development has been the discovery of the family automobile as an asset which could be hypothecated for loans. A large automobile-loan business has been developed by discount companies, by small loan companies, and by instalment finance companies, garages, and filling stations in states without adequate small loan regulation.

Behind this most recent expansion of consumer credit were the driving forces which had motivated the expansion of the twenties—sales competition among merchants, and the acquisition of durable goods by consumers. There were, in addition, two new stimuli. The first was government insurance of credit contracts for home remodelization and repair, which had much to do with the liberalization of credit standards in many fields. The second was cheap money, which not only brought banks into the field of consumer credit, but also made it profitable for many consumer credit agencies to expand their operations on the basis of bank credit.

The rate of expansion began to decline this summer. The first depressing influence occurred in April when insurance of FHA Title I contracts was discontinued. Then in June, several prominent sales finance companies announced a policy of tightening their credit requirements. This action might have been converted into a mere gesture by the exigencies of competition were it not for several other events. First, the banks appear to have forced more conservative credit policies by balking at the acceptance of long-term, low down-payment paper as security for loans. Second, many individual credit agencies were approaching the limits of expansion under existing capital structures, and the weakness of bond and stock markets led to the postponement of plans for new financing. Third, the consumer himself, watching the stock market and the business news with apprehension, turned conservative. Present trends are confusing. Some types of credit are still expanding, while others are liquidating. But it seems safe to conclude that the expansion, in the aggregate, had ended by the close of October.

While comparisons are hazardous on the basis of the data now available, the expansion seems to have stopped at a level very close to the 1929 peak. The loan balances of small loan companies, industrial banks and pawnbrokers are below their former peak, but this differential is more than compensated by the higher loan balances of personal loan departments and credit unions. Retail credit is also lower, but the receivables of instalment finance companies far exceed their 1929 level.

It scarcely needs to be said that the consequences of the extensive use of consumer credit penetrate deeply into our social and economic fabric. It is beyond the scope of this paper to appraise the institution itself or to discuss the many problems which have accompanied its growth. I shall undertake only a very brief discussion of a single problem which I believe to be highly important, especially at the present time, and which seems to have been neglected or misinterpreted in the past, i.e., the influence of quantitative fluctuations of consumer credit upon economic equilibrium.

Let us examine for a moment the characteristics of a single deferred-payment transaction. We shall take a very common example, sacrificing precise accuracy to rounded figures: A wage-earner buys an automobile, priced at \$800, on time payments. He pays \$260 down, leaving a balance of \$540. The charge for financing and insurance is \$60, making a total deferred balance of \$600 which he agrees to pay in 20 monthly payments of \$30 each.

From the purchaser's standpoint, this transaction involved a reduction of \$260 in his cash balance. But he has no sense of having

consumed \$260 worth of merchandise. Consequently, he is unlikely to change his rate of consumption in other directions except so far as he must readjust his budget to meet later instalment payments. From the standpoint of the finance company which bought the contract from the dealer, the automobile was only partially consumed. The down-payment covered the immediate depreciation in resale value that occurred when the automobile passed into the hands of the consumer, and subsequent instalment payments would presumably exceed its depreciation with use. But from the standpoint of the automotive industry, the car was immediately and completely consumed, in the sense that it had been moved into the hands of a consumer and the purchase price had been delivered. Whereas the wage-earner's cash balance was reduced only by \$260, the productive mechanism was stimulated by the immediate impact of the entire purchase price of \$800. The difference between these two sums, \$540, represents an artificial expansion of consumer's purchasing power. This sum is advanced to the automotive industry, moves through the industrial circulation, and reappears in large part as salaries, wages, and dividends long before the original purchaser has withdrawn it from the industrial circulation by completing his instalment payments.

This transaction differs only in degree from all other consumer credit transactions. Aggregate consumers' purchasing power is artificially expanded to the extent that the outstanding amount of consumer credit is increased, after allowing for unearned discounts and insurance premiums. In essence, the expansion of consumer credit represents a transfer of funds from the capital market into consumption. These funds must come either from savings or from an expansion of bank credit. If the rate of investment is lagging behind the rate of savings, this transfer may contribute to an equilibrium, not only by reducing the amount of funds seeking investment, but also by stimulating the demand for investment through the tertiary influences of increased consumer demand. If savings and investment were already in equilibrium, an expansion of consumer credit would increase production so far as additional factors of production were available and the process were not stopped by industrial bottlenecks. Thereafter expansion would merely inflate the price level.

Exactly the reverse of this process occurs when consumer credit is contracted. Part of the money which flows into consumers' incomes and which would otherwise be spent for consumers' goods is diverted to the repayment of debts, and is therefore transferred back again to the capital market. If this transfer were compensated by increased investment, the process would not result in deflation. But the tertiary influences of the contraction of consumers' purchasing power now

operate to reduce the demand for investment. Consequently, these funds tend to disappear through the liquidation of bank credit.

Consumer credit fluctuations appear to be the resultants rather than the causes of cyclical movements. But they exercise a powerful influence toward the acceleration of a cyclical trend once it is established. Expansion of consumer credit was undoubtedly an important factor in the prosperity of the twenties and its liquidation helps to explain the vicious-circle characteristics of the deflation of the early thirties.

The trend of consumer credit is an equally important element in the present business outlook. Its expansion, like the expansion of the federal government debt, which has precisely the same economic effect, contributed to the increase in business activity during the last three years. Both of these stimulating influences have now been removed. Among the many factors which are involved in the current business recession, the sudden elimination of these two stimulating influences is among the most important.

There is, however, one notable difference between federal deficit financing and consumer credit. Changes in the level of government debt are subject to control in the interests of economic policy. Fluctuations of consumer debt, on the other hand, are determined by the psychological outlook of thousands of creditors and millions of debtors. All the natural forces of competition and self-preservation lead to its expansion in the boom and to its contraction in depression. I do not believe that the credit capacity of consumers has been exhausted at present income levels. The pressure for liquidation does not appear to be great at the moment, but the potentialities of a rapid liquidation are disturbing. If this should occur, the problem of finding remedies for the present maladjustments in our economy would become much more difficult.

In conclusion, I wish to add a few words about the statistics of consumer credit. When our study was initiated, there were a few scattered and frequently incomplete state reports for small loan companies, credit unions, and industrial banks. For consumer loan agencies in other states, for the whole area of retail credit, for instalment finance companies, and for professional creditors, it was necessary to build up estimates by identifying the institutions and soliciting data from them, by culling the files of credit information services, by sample studies, and by a great variety of other devices. It has been a job for a detective rather than for a statistician. These methods have been tedious, expensive, and, in the end, only partially productive. We expect by spring to have a series of estimated year-end receivables for each of the principal types of consumer credit from 1923 to 1936.

Since this study was begun, and partly as the result of it, there has

been a material improvement in the current data. The number of state reports for consumer loan agencies has increased and their quality has improved. Several states have begun to collect periodic figures on personal loans of state banks. Only recently, the Census Bureau has initiated an excellent series of retail automobile receivables for finance companies. The Bureau of Foreign and Domestic Commerce and the Research Department of Dun and Bradstreet expect soon to initiate current series of receivables for various types of retailers. General interest in consumer credit statistics has increased enormously and it seems likely that we shall have, in the near future, useful current series for several types of credit.

If we are to have intelligible current figures for the whole field, however, there is still much to be done. The field of consumer credit is at present in a state of flux. Banks are rapidly increasing their part in consumer financing and it is essential to know something of the current trend of consumer credit balances in banks in order to interpret the figures for other types of agencies. Supervisory agencies have generally neglected not only the statistics, but also the adequate supervision of this type of bank service. The Census Bureau's figures for automobile receivables should be expanded to cover other retail financing. It is amazing that there are at the present time only the crudest of guesses concerning the total retail receivables of instalment finance companies. The federal income tax returns contain corporate balance sheets from which an annual series of receivables for various types of merchants and consumer credit agencies could be readily compiled. Such tabulations would serve to correct monthly series for biases which are unavoidable in samples based on voluntary reports. The field of receivables of doctors, dentists, and hospitals is still a statistical no-man's-land. There is also work to be done in the field of state reports. In many states, there is no public supervision of consumer loan agencies, to say nothing of official reports. In other states, there is some semblance of supervision, but no operating statistics are published.

There is a need not only for an expansion of the data of consumer credit, but also for coordination in the work of collecting them. The likelihood of wasteful duplication of effort is already apparent. I know of no field in which the centralizing influence of a committee of the American Statistical Association would be more useful.

CONSUMER FINANCING AND ITS RELATION TO THE COMMERCIAL BANK*

BY DAVID C. BARRY, *Vice-President*
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INTRODUCTION

UNTIL RECENTLY, American commercial banking has functioned primarily as an aid in the financing of agricultural, productive, and commercial enterprise. Small loans have been confined to regular customers or selected individuals of a better-than-average financial status. Hence, commercial banking has depended almost exclusively upon service to business organizations and to propertied individuals. These traditional types of lending have been declining rapidly, for many corporations, formerly borrowers, have refinanced publicly and privately and thereby have become more independent of commercial bank credit. This trend has been a major factor in the decline of bank earnings. As long as these types of service produced adequate volume and earnings, the average banker remained indifferent to, if not unaware of, the possibilities in consumer financing. There may have been other reasons for this indifference, but it is highly significant that today a steadily growing number of bankers have awakened to the seriousness of situation where much business, which the regular banking system can and should handle, is escaping them and going elsewhere.

Indeed, billions of dollars of small financing have been handled by agencies outside the regular banks and their demonstrated ability to produce steady and excellent earnings during none too profitable years for orthodox banking has accelerated the banker's interest in this field.

Another consideration is concerned with the newly discovered importance and technique of the banks' public relations. Consumer financing provides a rare opportunity to appeal to the "man on the street" by serving the general public in an efficient and helpful manner. The extension of the bank's service to this wider group is a factor of good will, which should not be ignored and which may have a decisive influence on the ultimate future of a banking system in a democracy.

Paralleling this new interest on the part of the banker was a change in his attitude and relation to the finance company. Finance companies were originally regarded by most bankers as performing an unorthodox function which placed them outside the pale of the established banking structure. Others believed it was a venture into uncharted fields, but,

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nevertheless, deserving of banking consideration and support. These sympathetic banks and bankers expressed their confidence in a tangible way by the extension of fairly liberal credit lines for the use of finance company managements. Such loans have proved to be sound for the bank and so well handled by the companies that today there are few of the larger banks which do not have finance company obligations in their loan portfolios. In addition, the record of the finance company, with respect to its own operations, has been excellent.

In view of all these developments, it is not altogether surprising that some bankers have already changed and others are changing their attitude toward consumer credit. They have learned that a loan to plain Mr. John Jones is quite as good as any other loans they make; that in bad times and good, John Jones pays his obligation as agreed. They have witnessed the testing and proving period, and having observed the extremely satisfactory results, many bankers have become convinced that consumer financing is a legitimate field for their own operation.

BANK PARTICIPATION IN CONSUMER CREDIT

One of the most discouraging factors in the consideration of consumer credit, possibly one of the greatest dangers, is the lack of accurate and complete figures pertaining to its total use. Not only have we no complete figures or other data on the activity of finance companies and other allied agencies but neither do we have facts showing the extent of bank participation, either directly or through other lending agencies. Such general figures as are available are more familiar to a statistical body such as yours than to the speaker. Therefore, instead of quoting estimated figures for a large group, I am presenting the results of operations of a single bank in a typical American industrial city in the hope that these known facts from a given situation will enable you to draw some conclusions from this brief paper. If you are desirous of estimating the effects of a more general adoption of similar plans by banks, you can multiply by any factor you want to arrive at your conclusions.

Rochester, New York, is an industrial city of slightly more than three hundred forty thousand population, situated in a county of about five hundred thousand and serving a trading area of about three-quarters of a million. Its industries are well diversified and there is a fairly high wage rate. We did not reach the peaks in boom times nor did we go into the deepest valleys in depression times. It is probably better than an average industrial city as a test tube for experimenting in consumer credit. Banking assets of the city total \$400,000-

000, including savings banks, and the total assets of the institution I represent are about one-fifth of the whole.

Our bank has an excellent physical set-up for consumer credit business consisting of a main office and eight branches, all but two of which are located in the City of Rochester. Practically all serve industrialized areas and have been established for several years. In addition, we have trained personnel and available space for centralizing our bookkeeping and accounting departments.

We realized an undertaking of this sort would present new operating problems but were confident we could solve them. Our operating procedure was somewhat complicated by the New York State Banking Law which had no specific provisions at that time governing personal loan business as it applied to the commercial bank. Later, the passage of the Stephens Act by the New York State Legislature clarified this situation somewhat and we now have definite operating conditions prescribed for us on personal loans.

Active participation in consumer financing was a matter to which our management had given a great deal of study and consideration for some time. Some of our officers had visited a number of institutions in the East and West which had been active in consumer credit. In addition, we, ourselves, had been initiated, in a small way, to this type of lending. We had been making loans under F.H.A. for several months and, for several years, had been administering a student loan fund trusted with us by the University of Rochester. These deliberations crystallized in early 1935 when the directors of our bank courageously approved what we call a six-fold program of installment loan activity:

1. The F.H.A. Plan.
(Modernization loans under the National Housing Act.)
2. The Budget Payment Plan.
(Financing household appliances through dealers.)
3. The Personal Loan Plan.
(Loans to individuals.)
4. The Auto Financing Plan for Dealers Only.
(Wholesale or retail financing of sales of autos.)
5. The Aid to Industry—Local.
(Financing of time sales of local manufacturers to local buyers.)
6. The Aid to Industry—Non-local.
(Financing or arranging for financing of time sales of local manufacturers in other areas.)

These six have since been modified and added to, our entire effort being to keep our operations flexible enough to meet any legitimate demand for consumer credit that may arise.

At this point, I should like to emphasize that we do not look upon our activity as being limited only to the opening of a Personal Loan Department. We look upon it as a venture (or an adventure, if you prefer) into the field of consumer credit, wherever that field may lead us. We believed consumer credit might become an important factor with many of our local industries and we were, and are, prepared to discuss the financing of sales of local products, either to local consumers or to consumers located elsewhere. With this viewpoint as a background, the Personal Loan Department took its proper place in the whole plan.

Not all plans were immediately effective. The F.H.A. Plan had been in operation for about two years. The Budget Payment Plan, which was an arrangement for financing the appliance sales of some eighty odd electrical dealers and our local gas and electric company, became effective in April, 1935. The Personal Loan Plan began operations in June, 1935. This has given us about two and a half years of operations as a basis for our analysis and the results may be interesting to you.

By July 16, 1936, in all groups combined, we had loaned \$1,813,000 to 10,442 borrowers which at that time had been reduced by payments to \$1,056,000 and 8,846 borrowers. On July 15, 1937, these figures had increased to \$3,797,000 originally loaned to 20,288 borrowers and the net outstanding had increased to \$1,494,000 represented by 12,847 borrowers. As of December 16, 1937, we had loaned \$4,732,000 to 25,244 borrowers, with a net outstanding of \$1,608,000 represented by 14,759 individual loans.

The average loan of the group, as originally placed, was \$187.20, with the average balance of the loan outstanding at this time reduced to \$108.99.

These loans have been made for the general purposes indicated:

	Per cent
1. House and electrical appliances	39.90
2. Refinancing existing accounts	15.14
3. Autos and accessories	13.01
4. Real estate investment and home improvement	10.78
5. Dental, medical, and hospital	4.59
6. Interest, insurance, and taxes	4.15
7. Business purposes	2.43
8. Clothing	1.74
9. Education	1.07
10. Miscellaneous	7.19
	<hr/> 100.00

Looking at this purpose classification, we find that automobiles and automobile accessories have formed a very popular reason for borrowing. This is in spite of the fact that we do not finance for more than twelve months and have no variations in our plan to accommodate this kind of business. At the present time, we have not only loaned substantial amounts of money for this purpose but the rate of growth as shown on a ratio chart is more pronounced than any other major classification. It is interesting to note, however, and of particular interest to bankers, that during the first ten months of our personal loan experience, refinancing existing debts was the greatest borrowing motive and at the present time is exceeded only by automobiles and accessories and household appliances. Hospital and medical bills have followed closely in amount loans for furniture, repairs and improvements, with the latter slightly in the lead at the present time.

In our Personal Loan Department, we attempt to carry this analysis a bit further. Our application forms request information from our prospective borrowers which give us a certain amount of general information about this type of borrower. Among other things, we have attempted to classify our loans by type of borrower. Charts are kept showing the principal subdivisions of each classification. We admit frankly that accurate scientific standards cannot be used in determining each and every applicant's real purpose in borrowing or his exact role in our economic mechanism, whether he be butcher, baker or candlestick-maker. But we feel that on the average our totals show a reasonably correct picture. The charts show that unskilled labor is our best customer with skilled labor a close second, although clerical help borrowed in greater amounts than skilled labor during the first year of the plan. Government employees (mostly school teachers) have used this service quite extensively.

Delinquencies of all kinds to date (and by delinquencies we mean all installments more than seven days old) number 940 items for a total of \$16,000, or just about 1 per cent of the net amount outstanding and about three-tenths of 1 per cent of the total amount loaned. There have been no chargeoffs during this two and a half year period and our best guess would indicate not more than \$4,000 of the \$16,000 in delinquencies will develop into loss items which, if it did occur, would be something less than one-tenth of 1 per cent on the total amount financed. This experience has occurred during improving business conditions and we are not unmindful that results during a period of recession may not be as favorable.

Obviously, such a result over so brief a period makes us feel confident this type of activity is not only a proper one but extremely desirable

for the commercial banker if he is situated in a community where the income of the majority of the residents is fairly regular.

In addition, the activity is productive of other business for the commercial bank and very frequently leads into installment equipment financing which might easily be financed through other channels if the banker were not installment finance minded.

FUTURE POSSIBILITIES FOR COMMERCIAL BANKS IN THIS FIELD

In attempting to outline the future possibilities for the commercial banks, attention must first be called to the inherent weaknesses in our banking system when attempting to meet competition of outside agencies.

Without taking any stand either for or against the dual banking system in this paper, nation-wide coverage by bankers which will effectively compete with finance companies is extremely difficult under our present forty-nine sets of banking laws. Perhaps the trend toward the extension of branch banking within certain areas or whole states will eventually make possible more effective banking competition. The Bank of America, in California, with its state-wide branch coverage, has given thorough proof of how effective bank participation can become.

Whatever the trend, the commercial bank has four courses from which to choose in determining its future policy:

1. Complete refusal to participate in consumer financing either directly or through loans to a finance company.
2. No direct lending but loans to a finance company.
3. No loans to finance companies but direct loans to others.
4. Loans to finance companies as well as direct loans.

If the banker adopts the first plan he has no consumer credit problem. If he adopts the second, that is, no direct lending but a willingness to loan finance companies, then he must become familiar with finance company operation and must determine for himself what good finance company management reflects in balance sheet and operating figures. If the banker adopts the third course, that is, no loans to finance companies but direct loans to others, then he has a different set of questions to consider. If the banker decides on the fourth course, that is, loaning directly and indirectly, then he must become thoroughly familiar with the whole field. He may have to decide that he will forego finance company business for direct lending particularly if the finance company feels itself strong enough to urge him to keep out of this activity. He may conclude there are limits to the amount of his commitment to all finance companies as well as limits to his direct loans.

After deciding upon his procedure, the banker might further plan whether he is going to seek cooperation from other banks or from finance companies. Cooperation between finance companies and the banks might be possible in two ways:

1. Feeding of business to the finance company by the bank when such business was of a character that permitted more efficient handling by the finance company.
2. Differential rate of interest to be paid by the finance company to the bank in the nature of a fixed charge by the bank for the establishment of a line of credit.

With this last suggestion there will be much difference of opinion and I want to digress a bit to remind you that in patents involving royalties there is a well-grounded theory that "making the royalty too high increases the urge to find a substitute." Just so is it in the relation of the finance company to the bank.

To be successful, the finance company must have large bank credit lines. These credit lines are necessary to permit rotation of loans and, in addition, provide the leverage necessary for profit for proprietary capital. The attempt to buy these credit lines too cheaply may increase the resistance to a point where banks generally go into the field and may eventually result in the complete withdrawal of the credit.

It would seem as though the banker had still another means of entrenching himself in this field. This would take the form of more complete cooperation among banks without regard to the finance company. Each participating bank might service each other's installment accounts in their respective areas for a fee. This would result in a complete matching of finance company nation-wide coverage which is not possible now.

One other word regarding decisions for the commercial banker. If alert, he has observed the gradually expanding field of the finance company. Much of this has been under the guise of equipment financing. While this is not consumer financing, it is direct competition to the commercial banker, made possible by successful consumer activity. He must measure carefully how much of this lending would have been his and how much more he is going to allow to go to others.

NEED FOR SCIENTIFIC APPROACH TO THIS WHOLE PROBLEM

In conclusion, it would appear that the whole field of consumer credit needs coordinated research. Such facts as are available are quite inadequate and we have no basis for accurately determining the effect of an increase or decline in consumer financing upon the business

structure. Whether or not there are potential causes of recessions within this field we cannot state positively. We see evidences of some concern regarding this in suggested investigation by Federal authority and by the questions raised regarding finance company subsidiaries of manufacturing companies. Conclusions reached by an impartial group such as yours would have a far reaching effect in future legislative action. So your conclusions may be definitely objective, I suggest the following for your consideration and study:

1. Cause facilities to be established to gather more accurate and complete data from all installment lending agencies.
2. Study legislative policies of State and Federal government with respect to lending authority, whether it be pawnbroker, licensed lender, finance company, credit union, industrial bank, loan association, savings bank, or commercial bank.
3. Study the ultimate place for all forms of "money credit," whether it be in our banking system or outside.
4. Suggest that Federal Reserve Bank require further segregation of its loan reports from member banks, this new subdivision to be "Consumer Credit Loans," including loans to finance companies.
5. Finally, for a specific study, it might be worth while to attempt to determine whether the commercial bank will ultimately absorb the finance company or whether the finance company will absorb the commercial bank.

A study by the American Statistical Association covering these five points would mean much to the banking profession in the years to come.

THE ECONOMIC FUNCTION OF THE SALES FINANCE COMPANY*

BY MILAN V. AYRES

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CONTRARY to a common impression, the sales finance company does not make loans to consumers. Its contacts with consumers are wholly thru the collection of installments on goods which the consumers have purchased. Many sales finance companies do indeed make loans in connection with what is known as wholesale financing or floor-planning. These loans, however, are made to merchants, not to consumers.

The sales finance company is a type of institution of rather recent creation. Apparently its birth occurred somewhere about the year 1914.

THE ORIGIN OF SALES FINANCE COMPANIES

The sales finance company is the offspring of the automobile industry, inasmuch as the first sales finance companies were formed specifically for the purpose of purchasing automobile installment paper. Installment selling, of course, was not a new device when the automobile industry adopted it. Furniture had been sold in this country on the installment plan for at least a hundred years before that, and many other kinds of goods for very substantial periods. While sales finance companies today are financing the sales of many kinds of goods besides motor vehicles, it is not at all certain that this type of institution would have been created if it had not been for the necessities of the automobile industry.

The automobile industry differs, and has always differed conspicuously, from every other important industry, with respect to its method of distributing its product. Automobiles are sold exclusively thru specific enfranchised dealers, whereas nearly all other products are sold thru all merchants willing to handle them. Automobile dealers are required to pay cash for their stock in trade before the receipt of each shipment, whereas most other merchants are allowed from sixty to ninety days to make payment. Very few automobile dealers have ever had enough capital to enable them to carry their own installment paper, whereas many other kinds of merchants can do that.

One of the reasons why an automobile dealer cannot carry his own installment paper is the fact that he has to pay for his new cars before

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he gets them. Another reason is that the merchandise he handles is costly and turns over very rapidly, so that his yearly volume is very large in proportion to his capital.

The finance company came into existence because of the insistent demand from purchasers that they be permitted to buy automobiles on the installment plan, and the utter inability of the dealers to accede to this demand unless they could immediately sell the installment contracts.

It is popularly supposed that the automobile manufacturers introduced the system of installment selling of their product, in order to increase sales. That is not true. They were all opposed to installment selling at first. The demand of the customers compelled installment selling, and thus directly brought about the creation of the finance companies. Naturally after finance companies had proved successful in the automobile field, some of them expanded their operation to finance other kinds of goods, and other companies were formed for the purpose of operating exclusively outside of the automobile field.

The number of sales finance companies increased very rapidly between the years 1919 and 1924, and apparently has not changed very much since the latter year. Unfortunately, no one has ever made an accurate count of such companies, but apparently the present number in the United States is in the neighborhood of 1,500.

EXTENT OF BUSINESS

It is a regrettable fact that there exist nothing like complete statistics of finance company operations. The only regularly available figures are to be found in the monthly reports prepared by the Department of Commerce on automobile financing. These are compiled from returns made by 456 companies. These companies purchased during 1936 a total of \$1,716,000,000 face value of installment notes arising from the retail sale of motor vehicles. They also did a large amount of wholesale financing in this field. That is, they made a great many loans to motor vehicle dealers to enable them to purchase their stock in trade. The total face value of these loans amounted to \$1,704,000,000. Thus, that year the total of wholesale loans made happened to be identical with the total face value of retail installment notes purchased, within a fraction of one per cent. That was accidental however. There is no necessity for these amounts being anywhere near equal. In 1929 wholesale volume was only 42 per cent of retail volume. That ratio increased each year until 1935, when wholesale exceeded retail by 21 per cent, dropping to equality in 1936.

I believe that these figures probably cover about 95 per cent of the

automobile financing done by sales finance companies. If that is correct, the total volume of such retail financing amounted to about \$1,806,000,000. Unfortunately we have no statistics on the financing of goods other than motor vehicles. My guess is that it amounts to one-third of the motor vehicle volume. That leads to a figure of \$2,408,000,000 as the probable total value of all retail installment notes purchased by finance companies in 1936.

There is a popular tendency to confuse installment volume with installment debt. The two things are very different, first because installment volume includes the cash down payment, and second because each installment contract is constantly being paid off.

Thus the 1936 retail volume of \$2,408,000,000 is very much more than the existing installment debt at any one time represented by these transactions. The automobile installment receivables of the four largest finance companies on December 31st represented 62½ per cent of their combined retail automobile volume for the year. If this figure is applicable to all of the finance company retail business, and I think it cannot be far wrong, we arrive at the figure of \$1,505,000,000 as the amount which retail installment purchasers owed to finance companies at the end of 1936.

Wholesale receivables were very much less, because, in the first place, very little wholesale financing is done outside of the automobile field, and because, in the second place, instead of being paid off during a period of from one to two years, the wholesale loans are all made on single notes of thirty to sixty days. I estimate wholesale outstandings at the year's end at \$247,000,000, which would mean that the total receivables of all the sale finance companies at that time amounted to \$1,752,000,000.

INSTALLMENT SALES DATA

These finance company figures are not identical with any statistics on installment sales, for the reason that finance companies do not by any means finance all installment sales. Many banks are in competition with them for the business; and many merchants including some automobile dealers, keep a part or all of their installment paper and collect it themselves.

The Department of Commerce, on the basis of the retail census for 1935, has estimated that total installment sales in 1936 amounted to four and one-half billions of dollars. If we assume that 25 per cent of that was paid in cash, we get \$3,375,000,000 as the volume of installment debt created, and if we again assume that 62.5 per cent was outstanding at the end of the year, we arrive at \$2,109,000,000 as the total installment debt at that time.

To recapitulate, the principal figures are as follows:

Installment sales	\$4,500,000,000
Debt created	3,375,000,000
Purchased by finance companies	2,408,000,000
Per cent purchased	71.3
Debt outstanding at end of year	2,109,000,000
Held by finance companies	1,505,000,000
Held by others	604,000,000
Wholesale loans of finance companies	1,800,000,000
Wholesale receivables of finance companies	247,000,000
Total receivables of finance companies	1,752,000,000

Perhaps I ought here to mention certain figures purporting to represent the existing installment debt, which have received wide publicity in recent months. One figure widely quoted was \$9,000,000,000 and another was \$13,000,000,000. Both of those estimates were gross exaggerations. There can be no reasonable doubt that the true figure is closely in the neighborhood of \$2,000,000,000.

BANK BORROWINGS

Nearly all sales finance companies borrow from banks the greater part of their working funds. It is considered entirely normal for a finance company to be borrowing two and one-half times its own capital and surplus. Thus if it has three and one-half million dollars invested in receivables, it may be that two and one-half millions, or 71 per cent of the whole, is borrowed bank money. At the end of 1936 the finance companies were probably in debt to banks in the amount of about one and one-quarter billions of dollars.

FINANCE COMPANY FAILURES

It has been said that during the depression no bank lost any money by reason of a finance company failure, while many finance companies lost money by reason of bank failures. That statement is very nearly correct. In fact, from the beginning of finance company existence, there have been hardly any failures of such companies resulting in serious loss to their bank creditors. This is true in spite of the fact that banks habitually loan to sales finance companies much larger sums of money than they would to practically any other kind of business enterprise with the same net worth.

This remarkable record is due principally to the very great diversity of risk and to the fact that the vast majority of installment purchasers pay up, even in periods of depression. The greatest risk of loss to a finance company is in its wholesale loans, and not in its retail install-

ment purchases; but because the wholesale loans are always secured by salable merchandise, serious losses, even in this field, seldom occur except thru deliberate fraud committed by the dealer.

Some finance companies have failed, usually as a result of mismanagement, tho in a few instances thru fraud, but nearly always the assets have been sufficient, or almost sufficient, to pay the creditors in full.

THE ECONOMIC FUNCTION

All of the foregoing may be regarded as preliminary—I think a necessary preliminary—to a discussion of the subject assigned to this paper, namely “The Economic Function of the Sales Finance Company.”

The most obvious thing that the finance company has done and is doing is that it makes possible a much larger volume of installment selling than otherwise could occur. This function was first exercised in the motor vehicle field. It is also operating in connection with the sales of the more recently developed kinds of typical installment goods, such as electrical refrigerators, washing machines, oil burners, household stokers, and radios.

I think that there can be no reasonable doubt that by facilitating installment sales, the finance company has been an important and essential factor in speeding up the adoption of such new and comparatively expensive devices as the automobile, the electric refrigerator, the oil burner, and the household stoker, and in so doing has advanced the rapidity of their development. I am convinced that if there had been no finance companies, all of these good things would today have been in much less general use, would be produced in much smaller volume, would be more costly per unit, and would be of poorer quality than they actually are. It is impossible to evaluate these effects in numerical terms. We cannot reasonably say that the number of these things being purchased today for cash would be purchased if there had never been any finance companies nor any installment selling. I feel quite certain that that is not true, and that present day sales would be even less than such a computation would indicate, because if there had never been any installment financing, these things would be more costly and less desirable, both of which attributes would cause fewer sales.

The sales finance company does more than facilitate installment sales. In the automobile field today, and to a less extent in some other fields, the finance companies are exercising a function which might seem to be more properly that of the commercial banks. The figures which I have already given in regard to wholesale financing are evi-

dence of that fact. You might well ask "Why do the finance companies exercise that function? Why do not the banks do it?" The principal reason is that these wholesale loans are secured by liens on the individual motor vehicles or on individual refrigerators, or other articles; and experience has shown that in order to do this business safely, it is necessary to make frequent periodical checks to determine that these articles which constitute the security for the loans are actually in the possession of the dealer, that they have not been "sold out of trust" without the payment of the loan secured by them. The banks don't like to do this checking and are not equipped for it.

The first sales finance companies were not created to do wholesale financing. The business was forced upon them thru the necessity of the automobile dealers to have this service and the unwillingness of the banks to perform it. This situation had developed by 1919 to such an extent that one of the specific purposes of General Motors Acceptance Corporation, which was created in that year, was to furnish wholesale financing for General Motors dealers. Now nearly all automobile finance companies do both retail and wholesale financing.

This combination of retail and wholesale financing has effects further back. In reality it finances the manufacturers, by enabling them to get spot cash for their output instead of waiting thirty, sixty, or ninety days. It has enabled them to avoid large amounts of borrowing which otherwise they would have to do. The automobile manufacturers adopted their policy of "sight draft with bill of lading" at the beginning because they had to. Bankers almost unanimously distrusted the automobile manufacturing business. They felt it could not succeed, and they felt also that it was contributing to the creation of ruinously expensive habits among the common people. The banks simply would not make loans to the manufacturers and they had to get cash for their product or go out of business. After the custom of getting cash had been well established, it proved so satisfactory to the manufacturers that they were never willing to give it up, but they have been enabled to continue it only by reason of the services provided by the finance companies to the dealers.

CONSUMERS GOODS VERSUS CAPITAL GOODS

We customarily think of installment selling as a phenomenon connected with the sale of consumers' goods, but for very many years an appreciable amount of it has been occurring in the sale of capital goods, that is, goods to be used in manufacturing or in conducting some other business. Some students of the subject have been so impressed with the importance of the distinction between consumers' goods and capital

goods that they have attempted to define installment selling so as to exclude capital goods, and have endeavored to confine installment selling statistics or calculations to data relating to consumers' goods only. This cannot be done with any accuracy for two reasons. In the first place, most of the presently available statistics do not make the distinction, and in the second place, there are a multitude of instances in installment selling where it is practically impossible to decide whether the goods belong in one class or the other.

The figures previously given relating to motor vehicle financing include trucks, yet trucks presumably are capital goods. They also include an immense number of automobiles which are used both for business purposes and for pleasure. It is impossible to make the desired classification. The census figures on installment selling include great numbers of mechanical refrigerators, oil burners, and stokers which were installed in homes or in apartment houses as a part of the permanent equipment, as well as some lumber, plumbing supplies, and the like sold for permanent incorporation in buildings. Were those consumers' goods or capital goods?

Outside of this overlapping field, however, manufacturers are selling on the installment plan, and finance companies are financing, considerable quantities of manufacturing and power plant equipment as well as equipment for stores and repair shops, all of which can be readily classified as capital goods. In doing this, the finance companies are to some extent taking the place of commercial bankers or even of the bond houses, because sometimes the alternative to buying machinery on the installment plan is the sale of a bond issue.

PAYING WHILE USING

One of the arguments sometimes used in defense of installment selling is that the installment purchaser is really paying for his goods as he uses them instead of paying before he gets them. There is much truth in that view. We commonly hear the statement that the installment buyer is mortgaging the future, but so is the man who rents a home and signs a lease agreeing to pay a stated amount per month for the next twelve months. In both cases he pays while using. The principal difference is that with the installment purchase he pays the full price during the first part of the period of use, after which use continues without further payment, while in renting a house, payments are spread over the entire period of use.

REPOSSESSIONS

Of course people sometimes make installment purchases which they cannot afford. One of the functions of the finance company is to pre-

vent this where possible. And they frequently do prevent it by impressing upon the dealer the fact that they will not buy installment contracts made by people who have insufficient income with which to pay, or who are already loaded up with debt. They prevent specific instances of such over-buying by refusing to purchase proposed contracts of that character. Nevertheless, they cannot prevent it altogether.

In 1936, 2.2 per cent of the new cars financed by the sales finance companies were repossessed, and 7.5 per cent of the used cars. That means practically that out of every one thousand people who purchased new cars on installments, twenty-two lost the vehicles purchased and what money they had invested in them, while seventy-five people out of every one thousand who had bought used cars had similar losses.

REPOSSESSION LOSSES

Percentages of repossessions, such as those above quoted, should not be confused with percentages of loss resulting from repossessions. Loss figures are much smaller because of the recoveries thru the sale of the repossessed property. The Retail Credit Survey gives the percentage of bad debt losses on installment credit accounts for 1936 for twelve kinds of retail stores. The loss ratio for automobile dealers is four-tenths of one per cent and for household appliance stores 1.2 per cent. The weighted average for the entire group is 1.2 per cent. The worst loss ratio is that of jewelry stores, which is 4.5 per cent.

No comparable figures are available for finance companies, but a computation based on the best available data indicate repossession losses of sixty-five one-hundredths of one per cent for motor vehicle financing.

TENDENCIES

I have not said much thus far which would properly come under the head of "Tendencies." There has been a tendency for many years for the total volume of installment selling to increase, but not very much tendency toward an increase in the installment selling percentage of any one particular kind of goods. The percentage of automobiles sold on installments is smaller now than it was ten years ago. In all probability, the percentage of electric refrigerators, furniture, washing machines, and most other kinds of specific items sold on installments, is less now than it was in 1929. The tendency for the total volume of installment selling to increase has been principally due to the increase in the volume of sales of those types of goods most adaptable to installment selling, namely fairly long lived articles which cost more

money than the average householder can readily spare at one time. In all probability, the volume of installment selling, as well as the percentage of installment sales to total retail sales, will tend to increase in the future by reason of the introduction of new articles or devices coming under this classification, and the increasing importance of such items in the family budget, due to a rising standard of living.

There has been a tendency during the past few years toward smaller down payments and longer time to pay out, and right now there is in operation the reverse tendency, namely, the exaction of larger down payments and a reduction in the length of time to complete payments. The New Deal, thru its offspring, the Electric Home and Farm Authority, and the Federal Housing Administration, was a principal factor in bringing about smaller down payments and longer time. These two New Deal agencies widely advertised the idea of nothing down or very little down, with from three to five years to pay, and this propaganda had its effect on the entire installment selling field.

The banks have been an important factor in the recent reversal of this tendency. It has been possible for the banks to exercise a strong influence in this direction by reason of the fact, already mentioned, that finance companies borrow a large part of their working funds from the banks.

The banks, for the past year or so, have been urging finance companies to insist on more conservative terms, and they in turn have been impressing upon the dealers the need to write more conservative terms into their installment contracts.

I do not wish to convey the impression that the present tendency to restrict installment terms is due entirely to the banks. Many of the dealers, and nearly all of the finance companies have had the same idea that installment terms had been made too easy. While this easing of terms may have been helpful in the climb up out of the depression, prudence suggested that more conservative terms ought to be adopted prior to the occurrence of another depression. Pressure from the banks, however, undoubtedly did much to activate this feeling.

GOVERNMENT REGULATION

Probably every year for several years past there have been bills introduced in one or more of the State Legislatures aiming at some kind of regulation of finance companies. Only two such bills have been passed, one in Wisconsin and the other in Indiana. The Wisconsin law is confined to the automobile field and is much more of a law to regulate automobile selling than it is to regulate finance companies. So far as the latter are concerned, it is of very little effect. The Indiana act

attempts to cover the entire field of installment selling of any kind of goods up to \$1500 in value, and to regulate finance companies purchasing installment contracts resulting from such sales. The Department of Financial Institutions is the regulating authority. As it has been administered, the act has not proven particularly objectionable; nor, I think, has it accomplished anything worth while.

What most of the advocates of regulation are really seeking is a means of putting a limit upon the finance charge, namely, the amount by which the time price exceeds the cash price. The difficulty with that idea is that it can only be accomplished by regulating every merchant who sells on the installment plan. To accomplish the purpose effectively it would be necessary for the supervising authority to determine both the cash price and the time price, which would be the extreme of price fixing. I am not at all sure that the movement to regulate sales finance companies will go much further than it has.

When I speak of regulating finance companies I mean government supervision and control of the operations of finance companies. It is the movement to do that which I think will not go very far. Further, I believe such regulation is unwise and unnecessary.

Some of the things which the would be regulators want to bring about can much better be accomplished, if they are worth while, and probably some of them are, by changing the laws which relate to the forms of the legal instruments used in installment selling and to the rights of sellers, buyers, assignees, and third party claimants.

DEBT-INSTALLMENT AND OTHER

It may be worth while to make some comparisons between available installment debt figures and certain other comparable data. For that purpose I shall confine myself to the year 1935 because of the availability of the information.

In that year, according to the census of retail distribution, retail installment sales amounted to 10.9 per cent of all retail sales. In the same year open accounts sales amounted to 21.3 per cent of all retail sales, so that the open accounts sales were practically twice as great as the installment sales.

According to the Retail Credit Survey, covering 1,367 stores of fourteen different classifications, collections each month on the open credit accounts amounted to 45.3 per cent of the outstandings at the beginning of the month, while the corresponding figure for installments accounts was 13.9 per cent. Assuming that these figures apply to all retail stores, and assuming further that in the case of installment sales 25 per cent of the price was paid down in cash at the beginning,

we can calculate that the average outstanding debt on the open account sales was \$1,273,000,000, and on the installment sales \$1,597,000,000. That is to say, the installment debt was only about 25 per cent greater than the open account debt.

According to a pamphlet issued by the Department of Commerce, long term debt in the United States at the end of 1935, including both private and public debt, amounted to \$118,537,000,000. Also at that time total outstanding bank loans amounted to \$20,329,000,000.

Thus, while the installment debt was only 25 per cent more than the total debt owed to retail stores on charge accounts, it was equal to a little less than 8 per cent of the outstanding bank loans and to only 1.35 per cent of the long term debt, consisting of stocks, bonds, mortgages, and the like.

Doubtless some of you have read Richard Dana Skinner's book "Seven Kinds of Inflation," and have been impressed by his argument that debt is the principal cause of the booms and depressions of the business cycle. He proposes a new system of banking and of financing whereby debt would be almost eliminated and the ownership of equities would be substituted. I cannot here, of course, review the details of that plan. I wish to mention only one minor portion of it, which is the suggestion of a system of "rental agreements with optional purchase prices, in place of installment debt contracts." What I want to point out is that such a substitution would make no difference.

The legal device by which automobiles and other things are sold on installments in England is called the "hire-purchase system." It is just what Mr. Skinner suggests. The legal instrument which is principally used in Pennsylvania, and to some extent in Massachusetts and other states, is called a bailment lease and it is in effect the same as the English system. It is a sort of legal subterfuge by which the buyer leases the goods from the seller in consideration of the payment of a stated rental each month for a given period, at the end of which time he is privileged to buy the goods by payment of a nominal sum. The effect of this system on the buyer, on the seller, and on the economic system is no different at all from the effect of buying under the more usual forms of installment instrument, which are the conditional sale contract and the chattel mortgage.

If Skinner is right, and I believe he is at least on the right track, in his analysis of the causes of the extreme fluctuations of the business cycle, then each type of debt should be subjected to close scrutiny to evaluate its share in the causation of booms and depressions. It is notable that the installment debt is certainly less than one and one-half per cent of the total debt, and probably not more than one per

cent. On that ground it would seem that its contribution to booms and depressions must be very slight.

Of equal significance is the fact that the installment debt has largely the characteristics of an equity holding rather than a straight money debt, is progressively liquidating over a relatively short period of time, and is in short already of the character which Skinner recommends as one of the elements of his proposed system for avoiding the recurrence of booms and depressions.

PUBLIC SUPERVISION OF CONSUMER CREDIT*

BY WILLIAM TRUFANT FOSTER

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A SWIMMER with a load on his back, struggling to keep his head above water, would hardly want handcuffs added to his troubles. About as welcome at the present time are proposals for further governmental regulation of business. Already too much regulation of the wrong sort has had its part in cutting down employment, production, and real wages.

Nevertheless, more effective public supervision of certain consumer credit agencies is desired by some of these agencies themselves. A proposal before the General Court of Massachusetts for state regulation of instalment selling and financing was favored by at least one of the large finance companies; the Credit Unions have favored federal and state laws for the regulation of Credit Unions; and leading personal finance companies have long favored more stringent laws for the regulation of their business, in states where workable laws exist; and are still asking for stringent laws, in such states as Texas, Washington, and Minnesota where, with freedom from state supervision, the business of making small loans to necessitous borrowers is a chaotic scandal. Further regulation of some sort over various consumer credit agencies is certain to come. The more effectively we study this problem, with the guidance which statistics can be forced to yield, the more likely we are to prevent unwise legislation, much of which is now under consideration by Federal and state law-makers.

WHY SUPERVISION IS NEEDED

For many centuries, the need of public supervision of money lenders has been evident mainly because, on account of the strategic bargaining position of the lenders, freedom of contract has enabled a powerful group to exploit a weak group. Always the necessitous borrower has had to take whatever he could get, wherever he could get it, on whatever terms he could get, often without knowing what the terms were. He has been in no position to bargain.

Partly for this reason, public supervision of banks, personal finance companies and other agencies which make cash loans to consumers is now accepted as a matter of course. Yet the business of instalment selling which, in effect, appears to have made last year roughly three billion dollars of small loans to consumers, is as free from regulation as the small loan business was a generation ago. Over the agencies

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which finance time sales, federal and state authorities, except in Indiana and Wisconsin, have no special supervision.

Yet, the more one studies the numerous agencies which provide consumer credit for the millions, the more one is convinced that all are much in the same boat. Instalment contracts often are refinanced as money loans. Agencies which make money loans often finance instalment purchases. Many commercial banks are now in both lines of business. There is, to be sure, this difference: sales finance companies do not make loans of actual cash to consumers. From the point of view of the consumer, however, this distinction has nothing to do with the question of the need of regulation. If the finance company did not enable the instalment buyer to make periodic payments on his purchase, he would have to borrow the money of some other agency and assume similar obligations as to payments. He would not care whether what he paid for the privilege was called "interest," or "carrying charges," or something else.

Always there is a "carrying charge," whether it is called by that name or by some other name. Always the consumer pays the charge, even when he is assured that there is "no carrying charge." All those who do the financing depend mainly upon the same source of payment, the earning capacity of the debtors. In all cases, it is important for the borrower to know exactly what rates he is obliged to pay and what other risks he is assuming. If there is necessity for supervision over one agency, there appears to be necessity for supervision over the others. In all cases the aims of supervision should be the same: fair terms, completely in the open, for both creditor and debtor; and for deception by either party penalties sufficient to restrain the unscrupulous minority, both among the lenders and among the borrowers.

AN EXAMPLE OF SUCCESSFUL SUPERVISION

The Uniform Small Loan Law, justified on the ground that the business of lending small sums to hard-pressed consumers is vested with a public interest, requires those who lend \$300 or less, at more than the legal contract rate, to obtain licenses. The law, taking into account the fact that the borrower may be easily confused by disguised charges and involved legal provisions, provides that *all* charges, by whatever name they may be called, shall be stated as one rate, computed on unpaid balances. The law requires also that each borrower be furnished with an exact statement, in plain English, of the terms of the loan. The law, taking into account the further fact that harassed borrowers are often in no position to question charges, sets a limit on rates. The original recommended maximum rate was $3\frac{1}{4}$ per cent a month. Today a majority of the states have a lower limit. The

law establishes supervisory authority in an administrative body, usually the state banking department, with power to refuse or revoke licenses, to request data on operations and, in a few states, to reduce maximum rates.

THREE NEEDS IN THE CASH LENDING FIELD

There are several urgent needs in the field of consumer credit:

1. The first need is workable laws, governing small cash loans, in those states which have no effective draft of the Uniform Small Loan Law. At present, half the states and the District of Columbia either ignore the problem, or have laws which in effect prohibit instead of regulate legal lending. This inevitably encourages illegal, sky-is-the-limit lending. In such states the lending goes on at a usual rate of 120 per cent to 240 per cent a year; but, in the under cover nature of the business, the statistics which are needed as a basis for sound legislation are not available.

2. A second need is better supervision in those states which have workable Small Loan Laws, but which have inadequate administrative machinery, personnel, and records.

The law provides merely the framework. How the business operates within the limitations of the bare requirements of the law depends on the energy and intelligence of the administrative body in charge. A state supervisor who has the power to require adequate reports and to investigate the licensees' books has at his command materials which reveal ways in which borrowers are being helped and ways in which they are not. With the cooperation of progressive lenders, the supervisor can work out socially-desirable regulations, close up loopholes, and put a stop to harmful practices. The capable supervisor does far more than gather figures and apprehend unlicensed lenders. He improves lending conditions to an extent beyond the expectations even of those who wrote the original law.

3. A third need, in some states, is effective supervision of such cash-lending agencies as pawnbrokers, industrial banks, personal loan departments of commercial banks, credit unions, and the lesser lenders, in order that borrowers may be informed fully and accurately regarding the costs of credit and the risks which they take. We need more data on the operations of these agencies, including clear and comparable statements as to interest rates and other charges, in order that reports of these agencies may have their part in the development of sound national financial policies. We should have, too, further studies of the needs of the borrowers, in order to determine to what extent each lending agency meets these needs. Most of the agencies which lend on preferred security and at rates lower than the maximum

permitted under the small loan act are not under effective public supervision. Only one state, New York, requires personal loan departments of commercial banks to confine their rates within limits computed on unpaid balances, but even New York does not require that borrowers be informed accurately as to the rates.

THE DEARTH OF ADEQUATE STATISTICS

How the gathering of adequate data may change our conceptions of what is going on is illustrated by the first comprehensive report on instalment financing—that for Indiana. Until recently, many of us have assumed that nearly all time sales, not financed by retailers, were serviced by sales finance companies. That assumption was basic to the use of the Department of Commerce Automobile Financing Series, covering some 450 organizations, as representatives of the entire automobile financing business. Recently, it has become evident that other types of financing agencies have entered the field; but how many there were or how important they were, we had no means of knowing. The Indiana report, as of the end of 1936, shows that in Indiana 256 state and national banks, Morris Plan companies, and small loan companies were engaged in time sales financing, as compared with 75 sales finance companies. Thus, in one of the 48 states, there were 347 agencies each with a volume of business large enough to warrant payment of the annual license fees.

The breakdown for the motor vehicle financing division is not complete, but what data there are appear to show that one-third of the volume in Indiana was handled by agencies other than sales finance companies. For the entire retail instalment financing business reported by licensees, 30 per cent of the volume and 35 per cent of the number of accounts were handled by banks, Morris Plan companies, small loan companies and miscellaneous companies. What we have learned from the two states which have undertaken supervision of instalment selling shows how much we might learn from adequate statistics of the whole business.

INSTALMENT SALES CREDIT

On the way up from the previous depression, instalment selling grew much faster than cash or charge account sales. Instalment sales credit outstanding is greater than that of any other division of consumer credit, with the exception of open charge accounts; and, with that one possible exception, instalment credit touches the lives of more individuals and more families than any other kind of credit. Yet, in spite of its enormous size and potentialities for good and evil, instalment selling and financing is not subject to the kinds of public supervision which are exercised over less important consumer credit agencies.

In the selling of merchandise, the trend has been away from the "public-be-damned" attitude, expressed in the ancient slogan, "Let the Buyer Beware." Today progressive retailers are committed to a new policy, not only in theory but also in practice. Even if the policy costs merchants millions of dollars a year in losses on returned goods, the policy pays, for the customer buys more freely if he knows that he can get credit or a cash refund for merchandise which does not satisfy him. This "Let the Merchant Beware" policy creates customer confidence.

But when it comes to selling credit, many of the credit agencies guarantee no such satisfaction. When the customer buys credit along with merchandise, often he buys a package of unknown contents. The commodity is sold on the "buyer beware" policy, but the buyer does not know what to beware of. If he finds later on that what he bought is not what he thought he bought, often he has no redress. He has committed himself to payments extending over a year, or two years, or even three; and once he has started, he cannot stop without suffering what is to him a large loss.

REGULATION NEEDED FOR INSTALMENT SALES

Conceivably, instalment sales agencies might regulate themselves, but they have not done so even to their own satisfaction. Abuses in this business are a grave concern to the reputable companies, which are a large majority of all the companies. Many of them, as reports of their own conventions show, would like to abandon the mulcting of consumers through reserves, bonuses and packs; but in the stress of competition they find it difficult to do the right thing. They denounce deception in rates of charge, yet every day in this respect thousands of dealers hoodwink their customers. In principle, the finance companies disapprove of contracts which fool buyers, yet their own representatives sometimes use such contracts. The reputable concerns would like to clear the business of the fringe of dealers who overcharge for insurance, and then in some cases do not bother to place the insurance, and dealers who repossess automobiles without notice, and then sell them at fake auction sales; yet these and other abuses persist.

Probably fewer than 15 per cent of instalment dealers are guilty of the worst frauds, yet the whole industry suffers because of the acts of the buccaneering minority.

Although the worst frauds are not common, concealment or misrepresentation of the true rate of charge on unpaid balances certainly is common. Each dealer is at liberty to state his rates in any way he pleases, and much ingenuity is shown in making the rates appear

lower than they are. A survey, conducted by authority of the General Court of Massachusetts, showed that the true annual rate in about 500 cases varied from 0 per cent to 943 per cent, and that in the majority of cases the rate was at least twice as high as the rate quoted by the seller. In 105 cases, the rate quoted by the dealer was 6 per cent; but in over nine-tenths of these cases the actual rate, computed on the average amount of credit extended, was above 10 per cent, and in one-third of the cases the rate was above 30 per cent.

The Massachusetts Committee on Consumer Credit concluded that, for the benefit of consumers and of the industry, the law should require a clear, uniform statement of total carrying charges, on a true interest rate basis, such as a per cent per month on actual, unpaid balances.

The gains which might be achieved by such a law are suggested by the success of the Uniform Small Loan Law. So well has the law achieved its purpose that in Massachusetts, where this type of law has been longest in effect, over 200,000 loans are made each year by licensed companies, with scarcely any violations of the law; and about fifty of the leading social welfare agencies, as well as the personal finance companies, have asked that no changes be made in the law.

How much better off the important instalment sales business would be, if it were so effectively supervised by the state that the social welfare agencies had virtually no frauds or deceptions to complain of.

Instead, state small loan supervisors are constantly requested to give relief from real or fancied instalment sales wrongs, despite the fact that they have no authority to deal with such cases. Of the 34 creditors each of whom had brought 50 or more wage executions against New York city employees, as of May 31, last year, 22 were jewelry, furniture, clothing and general merchandise stores. In Wisconsin, one of the two states that now has authority to supervise the instalment selling of automobiles, 860 complaints were filed in the first eighteen months against licensees engaged in the selling and financing of time sales, while in the same period, there was only one complaint filed against companies which were licensed under the Small Loan Law.

WHAT THE INSTALMENT BUYER SHOULD BE TOLD

In many cases, the instalment buyer does not know many things which he must know, if he is to buy intelligently and without regrets.

1. He does not know the price, in terms which enable him to compare the price with other credit packages in other credit markets. If the price is quoted as a per cent of something, the price seems simple

and definite; but if the buyer asks—as he usually does not ask—per cent of what?—frequently he gets no illuminating answer. If, on the other hand, the price is quoted in dollars and cents, the buyer has a useful measure, but not one which enables him easily to compare the price with the price of the same credit service elsewhere; for, since credit always covers a given amount of money for a given time, the only basis for comparing costs in different credit markets is a per cent of the dollars enjoyed for a unit of time, such as a per cent per month of the actual, unpaid balance.

“How much are credit potatoes today, Mr. Merchant?”

“They are \$2.87, Mrs. Customer.”

“For how much credit?”

“For enough to allow you to pay in ten equal instalments.”

Since the bags of credit potatoes seldom contain the same number of pounds, the charges in dollars and cents do not readily reveal comparative rates.

2. Again, the customer does not know how long he will be allowed to lapse in payments before the merchandise will be repossessed or his wages garnisheed.

3. He does not know what repossession charge he will have to pay to get his merchandise back.

4. He does not know what penalty charge he will be assessed for late payment.

5. He does not know what refund, if any, he will be granted if he pays any of the instalments before they are due.

6. He does not know what legal fees may be charged against him.

7. He does not know what security he gives. If he assumes that repossession of his radio set terminates his obligation, he may assume wrongly; he may have given a lien on his automobile, or on his household furniture, or, without knowing it, he may have given a wage assignment.

8. He does not know what insurance is provided, even when he pays a special charge for insurance.

There are other things which—not always by any means, but often—the buyer does not know. Some are to be found in fine print in the legalistic language of the contract, but the buyer would have to hire a lawyer to tell him what they mean. If he discovers them at all, it may be after he has signed the contract.

Without the protection of strong instalment contracts, the seller or his assignees would be victimized by unscrupulous consumers, of whom there are enough to bankrupt careless credit-grantors. If the seller could not take swift, effective action against the “skip” and the “dead-

beat," there would be unbearable additions to his already high costs.

But a contract, implemented with strong legal weapons, all in the seller's favor, may be dangerous, as these examples show:

1. Wage assignments are used in sales to persons of meagre income or low credit rating, and in the sale of merchandise with no resale value, and the judicious use of these wage-assignments, in many states, is at the discretion of the seller.

2. Liens on merchandise other than the subject of the sale enable unscrupulous dealers to sell to persons of no credit standing, with the intention of making profits from the seizure of the buyers' property.

3. When a series of purchases are made over a long period of time, under an open-end contract, the buyer may find that, after he has paid enough to cover all costs on the furniture which was first covered by the contract, and on the washing machine which was bought under the same contract later on, he does not own either the furniture or the washing machine, because he has not paid in full for the baby carriage which was his latest purchase.

4. Occasionally, summary treatment in repossessing goods is justifiable, but in a few cases goods are repossessed at slight excuse, when only one or two payments remain to be paid, with loss to the purchaser of his entire equity. In one city about seventy automobiles a month are reported to the police as stolen, which have been repossessed without the knowledge of the purchaser.

5. Repossession and delinquency fees are kept within reasonable limits by better grade firms, but other firms—without the restraint of law or public supervision—charge all the traffic will bear.

6. The public sale of repossessed merchandise often is the best way of clearing up a hopelessly delinquent account, but many such sales are "fixed." A repossessed car which is worth \$250 in the open market may be "sold" to a closed group of buyers for \$150, and a court judgment secured against the instalment buyer for the balance due, plus various costs.

The scrupulous concerns, which, let us repeat, are a large majority of all concerns, rarely take advantage of the provisions of these one-sided contracts, except in dealing with dishonest or wholly unreasonable debtors; but these same harsh provisions can be used at any time by piratical dealers. In some states, the confession of judgment clause in the contract denies the buyer any opportunity to defend his case; the acceleration clause makes the entire amount due and payable, when a single payment is overdue; and the 15 per cent allowed for attorney's fees may be 15 per cent of the original unpaid balance, after most of that balance has been paid. More effective state supervision of instalment selling and financing is plainly needed.

RATE FIXING OF QUESTIONABLE BENEFIT

It is questionable, however, whether state regulation of charges is needed. No man, no commissioner, no banking department is wise enough to know what the rates ought to be in thousands of cases, each one of which involves risks and expenses different from all the others. Any rate which a state legislature would consider politically expedient would be too low to cover the necessary expenses of a large proportion of instalment sales. Small loans, repayable by means of many small payments, are necessarily expensive loans. Even a true annual rate of 90 per cent on a tire, which appears to be a common rate, with the balance payable in ten weekly instalments, is not necessarily an unwarranted rate. It does not necessarily guarantee any profit at all.

Naturally, when Utah fixed the maximum rate on automobile time sales at 8 per cent, no dealer in the state paid the slightest attention to the law; and when Wisconsin forbade dealers to charge an interest rate of more than 15 per cent, many dealers charged about what they would have charged anyway, but did not call it "interest." Futile for the same reason is the 6 per cent law now proposed for Rhode Island. The rates put into effect by the Indiana Commission are enforceable because they are so high that they enable most of the dealers to do business at a profit; but the rates were not set by the Legislature, and they can be changed at any time by the Commission.

NEED OF STUDYING BORROWING IN ITS
EFFECT ON SPENDING HABITS

The effect of debt on family expenditures is another large, unexplored field for investigation. Spot studies of the purposes of borrowing are only a clue. To what extent do families incur debt for coal and clothing and instalment purchases which ultimately must be liquidated through money loans? To what extent do those who borrow to pay off accumulated debts assume new debts of the same sort, while they are liquidating their money loans? Answers to these questions await studies of individual families, extending over months and years of their debt-assuming and debt-liquidating experience. Studies as of one date are not enough. The Urban Study of Consumer Purchases, which covers the change in certain types of indebtedness through the transactions occurring in one year, is suggestive, but it suggests mainly avenues for further study.

These investigations would throw light not only on the effects on purchasing power in general, of saving and dissaving, and of borrowing and liquidation through prosperity and depression; they would provide also a basis for judging the effect of borrowing on the welfare of in-

dividual families. Nearly everyone can see the value to a family of a loan when the family is in a jam, or really has an unusual opportunity that requires ready cash. But we may question the advantage of borrowing, at the relatively high rates which must be charged for small, unsecured loans, if the borrower remains continually in debt. Since the chronic borrower shifts his obligations back and forth among various types of creditors, we can learn his behavior, not by studying one class of creditor, but by studying the borrower himself.

ADDITIONAL STATISTICAL STUDIES NEEDED

The fact that in most of the chief industrial states the personal finance business is in a mature stage is no excuse for complacency. The legal aid societies and social welfare agencies endorse small loan laws because they have brought about conditions markedly better than those that exist without such laws—not because they are perfect.

Consider, for example, the maximum rates. The reason for allowing a given rate on small loans is that it appears to cost at least that much to make them; but it does not follow that any rate, once adopted, is right for all time to come. The rate is a question of "how much," and quantitative measurement calls for scientific tools. It calls for market analysis to find out what classes of borrowers are served at any given rate, and what classes are left without any legal source of loans. It calls for the use of accounting technique in the analysis of financial statements, and for development of uniform accounting practices, in order that all states may have the advantage of rate experiments in any one state. Further, it calls for development of standards of comparison for gauging the adequacy of earnings. Is a 6 per cent rate of earnings on assets, used and useful in the business, about right? Or is 4 per cent right, or 8 per cent? How do the earnings of a cross section of lenders, big and small, compare with the earnings of other business groups, composed of large and small units? What is the cyclical variation in profits and what bearing has it on the proper rates of charge at one stage or another of the business cycle? Answers to such questions depend on scientific analysis, but first of all they require data, much of which will be made available only through public supervision of consumer credit. Until we have such supervision, future sleuths in this field will have to say, as Mr. Rolf Nugent recently said, "The job is one for a detective rather than for a statistician."

EXPENDITURE PATTERNS OF URBAN FAMILIES*

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THE OPPORTUNITY was afforded at a previous meeting of the American Statistical Association for explaining the objectives and sampling procedures of the Urban Study of Consumer Purchases.¹ The present report comes at a point in the study when data on family expenditures have been partially tabulated and permit some preliminary discussion of their implications. It is not within the scope of this paper to enter upon a detailed description nor general interpretation of the findings, which will have their place in appropriate government bulletins. Discussion of the findings will here be directed toward one phase of a selected problem—the graphic presentation of family expenditure patterns so that differences may readily be visualized between expenditures at different income levels and between different communities or samples of the community.

Before proceeding to an examination of the data here presented, it may be desirable to recall the general program of the study. The Study of Consumer Purchases is a joint effort by several departments of the federal government to ascertain the distribution of incomes among American families and the manner in which those incomes are disbursed. The Bureau of Home Economics of the Department of Agriculture has conducted the investigation among 80,000 town, village and farm families. The Bureau of Labor Statistics of the Department of Labor has been responsible for the study in urban communities. It has collected data on family incomes from more than 300,000 families scheduled in a random sample of thirty-two cities with populations varying, in degree of urbanization, from the metropolis to the community of around 15,000 inhabitants. From this random sample of urban families, a total of somewhat less than 25,000 families was selected for a detailed study of their family expenditures, the sample being controlled so as to permit the analysis of an approximately equal number of families within each of seven occupational divisions, from five to nine family types (depending upon the community), and a maximum of twenty income brackets. Expenditure schedules were secured only from native white families which contained both husband and wife (except in seven communities where negro families were

* Revision of a paper presented at a joint meeting of the American Statistical Association with Section K of the American Association for the Advancement of Science, Denver, Colorado, June 25, 1937. The assistance of Mr A C Rosander, in the preparation of tabular materials, is gratefully acknowledged.

¹ "Methods and Problems of Sampling Presented by the Urban Study of Consumer Purchases," by Erika H. Schoenberg and Mildred Parten, this JOURNAL Vol. 32 (June 1937), pp. 311-322.

separately scheduled). A corresponding portion of the random sample, likewise consisting of native white families with husband and wife, has been used for weighting the expenditure data by income, occupation and family type. The detailed expenditure schedules and check lists include information on the quantities purchased and amounts expended for specific commodities and services. The tables on specific commodities and their average prices have not yet been completed, but we do have summaries of expenditures by the main categories of goods and services for a number of cities in the study. The material used for illustrative purposes in the present paper is taken from two cities—Chicago and Denver.

Distribution of expenditures by income. The first line of analysis in any study of family expenditures would be expected to deal with the relation between income and expenditures. How does the distribution of family funds at the \$2,000 income level differ from the manner in which the income of families at the \$1,500 level is spent? Which categories of expenditure increase at a relative rate more rapid than the rise in the income level; which would increase more gradually than income? What would be the rate of increase of expenditure for a given item of family consumption, as the income is changed from one specified level to one which is ten per cent higher? These and similar questions find their answer as we establish the relationships existing between income and expenditures; occupation and expenditures; family type and expenditures. They have a place in marketing programs, in family budgeting, in estimating national consumption, in arriving at just wages scales, in efforts to keep production balanced with consumption—in a myriad of situations affecting private or public policy touching our national social and economic life.

The distribution of the expenditures of Chicago and Denver families, by income levels, is summarized in two accompanying tables. In Table 1, which covers the major categories of expenditure, the occupational groups have been combined; the income brackets included are those in which schedules for all occupations were taken in the controlled sample.² In Table 2, the percentages of total expenditures going to Food, Clothing and Personal Care are shown for two different occupational classes: wage earner and salaried executive. There the expenditures are included for income brackets below \$1,250 in the case

² Families were not interviewed for expenditure schedules in the professional and executive business classifications at incomes below \$1,250, nor in the wage earner and clerical classifications above \$5,000. The total number of detailed expenditure schedules for the Chicago sample is 2,610. Of these, 64.1 per cent, comprising a sample of 2,223 families, are in the income bands between \$1,250 and \$5,000 for which all occupational groups were scheduled. The random sample of Chicago schedules, by which the expenditure data are weighted, included 28,510 families.

TABLE 1
AVERAGE EXPENDITURES AND PERCENTAGE DISTRIBUTION OF FAMILY MONEY
EXPENSE FOR ALL OCCUPATIONS AND ALL FAMILY TYPES OF NATIVE WHITE
NON-RELIEF FAMILIES, BY INCOME CLASSES, 1935-36

City and category of expenditure	Income class								
	\$1250- 1499	\$1500- 1749	\$1750- 1999	\$2000- 2249	\$2250- 2499	\$2500- 2999	\$3000- 3499	\$3500- 3999	\$4000- 4999
CHICAGO									
Total expenditure (100 per cent)	\$1351	\$1606	\$1797	\$1988	\$2223	\$2473	\$2753	\$3152	\$3760
Percentage of total for.									
Food	39.0	36.5	34.4	33.0	34.4	31.7	31.3	29.9	28.1
Clothing	8.1	8.5	9.1	9.8	9.5	10.5	10.5	11.8	11.6
Housing, fuel, light, re- frigeration	27.1	26.7	25.9	24.3	23.1	22.4	19.9	20.8	18.3
Other household opera- tion	3.6	3.5	3.8	4.3	4.7	5.1	5.6	5.8	6.8
Furnishings, equipment	2.1	2.4	3.2	3.3	3.0	3.1	3.0	3.7	2.7
Automobile*	2.7	4.1	5.4	6.5	5.3	6.9	7.2	7.4	8.8
Other transportation	2.9	2.4	2.5	2.2	2.3	2.3	2.3	1.9	1.9
Personal care	2.1	2.2	2.0	2.1	2.3	2.2	2.1	2.2	2.1
Medical care	4.4	4.8	4.4	4.6	4.9	4.7	4.6	4.6	5.2
Recreation	2.2	2.2	2.6	2.8	3.1	3.2	4.0	3.3	3.8
Tobacco	2.2	2.4	2.1	2.0	2.1	2.2	2.2	2.0	1.9
Reading	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0
Education	0.4	0.6	0.5	0.8	0.8	0.9	1.0	1.1	0.9
Gifts, taxes, etc.	1.8	2.0	2.4	2.8	2.8	3.3	4.6	4.2	6.6
Other items	0.2	0.6	0.6	0.4	0.6	0.5	0.6	0.3	0.3
DENVER									
Total expenditure (100 per cent)	\$1384	\$1591	\$1739	\$1969	\$2068	\$2362	—	—	—
Percentage of total for.									
Food	30.3	30.0	28.7	27.8	27.7	26.0	—	—	—
Clothing	9.8	10.4	10.2	10.6	11.3	11.8	—	—	—
Housing, fuel, light, re- frigeration	21.7	20.8	22.4	19.5	19.6	19.3	—	—	—
Other household opera- tion	4.0	3.9	4.4	4.8	4.6	4.8	—	—	—
Furnishings, equipment	3.4	3.6	4.1	5.0	3.3	3.5	—	—	—
Automobile*	10.3	10.6	9.9	11.8	12.0	12.8	—	—	—
Other transportation	1.5	1.9	1.4	1.6	1.6	1.7	—	—	—
Personal care	2.4	2.5	2.2	2.1	2.3	2.2	—	—	—
Medical care	6.7	6.8	6.2	5.6	5.3	5.1	—	—	—
Recreation	2.5	2.9	3.5	3.3	3.5	3.5	—	—	—
Tobacco	2.1	1.9	1.7	1.6	1.8	1.4	—	—	—
Reading	1.2	1.1	1.0	1.0	1.0	0.9	—	—	—
Education	0.8	0.5	0.7	0.8	1.1	1.2	—	—	—
Gifts, taxes, etc.	2.7	2.7	3.3	4.1	4.4	5.0	—	—	—
Other items	0.6	0.4	0.3	0.4	0.5	0.8	—	—	—

* Includes net expenditure of car bought as well as operating expenses.

of wage earners, and the income brackets above \$5,000 for the salaried business classification.

A distinction may be noted between the samples of families shown in the tables and charts presented in this paper, and those treated in most previous studies of family living. Data on family expenditures have traditionally been confined to so-called working class families. Generalizations on the relative urgency of different items of expenditure at successive income levels—Engel's laws and their subsequent refinements—are consequently limited to income levels associated with wage earners and the lower clerical groups. The samples of families obtained by the Urban Study of Consumer Purchases differ from those of the working class studies in two important respects. First, the

families scheduled in the Urban Study include not only wage earners and clerical workers, but professional people, business executives and retired persons as well. Secondly, the annual family income extends from less than \$500 to more than \$10,000. It becomes a matter of particular interest, therefore, to see how far along the income scale the traditional concepts of necessities versus luxuries, and of relative degrees of urgency, may apply.

TABLE 2
EXPENDITURES FOR SPECIFIED ITEMS AS A PERCENTAGE OF TOTAL EXPENDITURE
FOR FAMILIES OF WAGE EARNER AND SALARIED BUSINESS OCCUPATIONS
(NATIVE WHITE NON-RELIEF FAMILIES) BY INCOME CLASSES, 1935-36

City and income class	Food		Clothing		Personal care	
	Wage earner families	Salaried business families	Wage earner families	Salaried business families	Wage earner families	Salaried business families
CHICAGO						
\$500- 749*	41 9	—	5 6	—	2 2	—
750- 999*	39 5	—	7 8	—	2 0	—
1,000-1,249	40 8	—	7 6	—	2 1	—
1,250-1,499	40 5	34 5	7 8	7 6	1 9	2 4
1,500-1,749	37 3	34 3	8 7	8 4	2 1	2 5
1,750-1,999	34 9	33 1	8 9	8 8	2 0	2 0
2,000-2,249	33 9	32 7	10 1	9 3	2 0	2 2
2,250-2,499	35 5	32 5	8 9	10 3	2 1	2 4
2,500-2,999	33 1	31 5	9 6	10 0	2 1	2 3
3,000-3,499	34 0	29 2	11 5	10 0	2 2	2 3
3,500-3,999	33 8	27 7	11 0	10 6	2 3	2 1
4,000-4,999	28 8	26 0	12 4	12 6	2 2	1 6
5,000-7,499	—	24 4	—	12 0	—	—
7,500-9,999	—	21 2	—	12 0	—	2 2
10,000 and over	—	15 7	—	12 7	—	1 3
DENVER						
\$500- 749*	39 4	—	6 3	—	2 1	—
750- 999*	36 8	—	8 2	—	2 2	—
1,000-1,249	36 0	—	8 9	—	2 5	—
1,250-1,499	30 0	30 2	9 0	10 4	2 2	2 7
1,500-1,749	31 1	29 7	10 7	14 2	2 5	2 3
1,750-1,999	30 4	28 2	9 9	10 3	2 3	2 2
2,000-2,249	26 8	26 9	11 0	10 7	2 1	2 2
2,250-2,499	31 2	25 9	11 7	12 9	2 5	2 0
2,500-2,999	29 7	24 9	9 8	11 6	2 2	2 2
3,000-3,499	—	24 8	—	12 8	—	2 2
3,500-3,999	—	20 8	—	12 5	—	2 3
4,000-4,999	—	23 3	—	14 1	—	2 3
5,000-7,499	—	20 8	—	12 4	—	2 3
7,500 and over	—	14 4	—	12 8	—	1 2

* For the income intervals between \$500-1,000, the mean total expenditures exceeded the upper limit of the income interval, being as follows

Income	Average total expenditures	
	Chicago	Denver
\$500-749	\$ 830	\$748
750-999	1,021	894

The percentages shown would therefore be higher if on income rather than total expenditures.

A casual inspection of the expenditure tables will demonstrate that we may need to revise the traditional lines of demarcation between necessities and luxuries, for a sample that includes the upper income bands. Under the heading of food, for example, we have to reckon with more than the increase in adequacy of the diet. If the criterion of nourishment were the prevailing consideration, we should have that

sharp tapering off in food expenditures which was emphasized in the wage earner studies, after the requirements of hunger were met. Instead, we find that the percentage spent for food declines but gradually for incomes between \$1,500 and \$5,000. With increasing income, the food bill takes on the expenses of eating out and entertaining, as well as the introduction of delicacies into the food budget. Housing, including fuel, light and refrigeration, reflects a behavior pattern more in keeping with the familiar notion of a necessity that becomes relatively less crucial in the total income pattern as income rises. There is evidence that in large cities there may be a level of rent below which living accommodations cannot be had, so that there is little difference in housing costs, on a dollar basis, between the rents paid by families at \$1,250 and those of families with \$500 incomes. Clothing offers a contrast to food and housing, at least up to \$5,000, in that it takes an increasing percentage of the total family budget. There are minor items like personal care, usually regarded as luxuries, which are nevertheless necessities in fact, showing a marked tendency to remain constant as a percentage of expenditures throughout the income range, at least to \$10,000.

In comparing the proportions of different items of expenditures at successive income levels, it is important to note whether the base for computing the percentage distribution of expenditures is *total expenditures* or *total income*. Since savings and investments account for a progressively larger share of total income as income increases, the percentage spent on current consumption goods comes down rapidly as we approach the highest income brackets. Thus in the case of clothing, the percentage spent on that item may continue upward until the income bracket of \$15,000 is reached, if total expenditures are taken as the base; but the percentage tends to decrease above \$3,000 of income, if income is taken as the base.

Analysis of expenditures by linear regressions. A definitive summary of the original expenditure data per se must await completion of tabulations and, in particular, the analysis of specific commodities and services which enter into the summary categories of expenditures. The immediate objective at this point is to consider the utility of linear regressions for measuring and interpreting the patterns of family expenditures.

The pattern of expenditures for a given sample of the population may be delineated as a series of straight lines in a fan-shaped figure, in the form illustrated by Charts I and II. On these charts the average expenditures for the main categories of consumption are cumulated, layer on layer, until the position of the uppermost line represents the amount of total expenditure or total income, whichever is greater. If

CHART I

EXPENDITURE PATTERN WAGE - EARNER FAMILIES CHICAGO, ILL. 1935-36

EXPENDITURES
IN DOLLARS
5,000EXPENDITURES
IN DOLLARS
5,000

- 17 NET CHANGES IN ASSETS & LIABILITIES
16. OTHER FAMILY EXPENSE
15. GIFTS AND TAXES
14. EDUCATION
13. READING
12. TOBACCO
11. RECREATION
10. MEDICAL CARE
9. PERSONAL CARE
8. TRANSPORTATION
7. FURNISHINGS AND EQUIPMENT
6. OTHER HOUSEHOLD OPERATION
5. FUEL, LIGHT, REFRIGERATION
4. HOUSING (*Adjusted*)
3. HOUSING (*Money Expense*)
2. CLOTHING
1. FOOD

4,000

3,000

2,000

1,000

4,000

3,000

2,000

1,000

500 1,000 2,000 3,000 4,000 5,000

INCOME IN DOLLARS

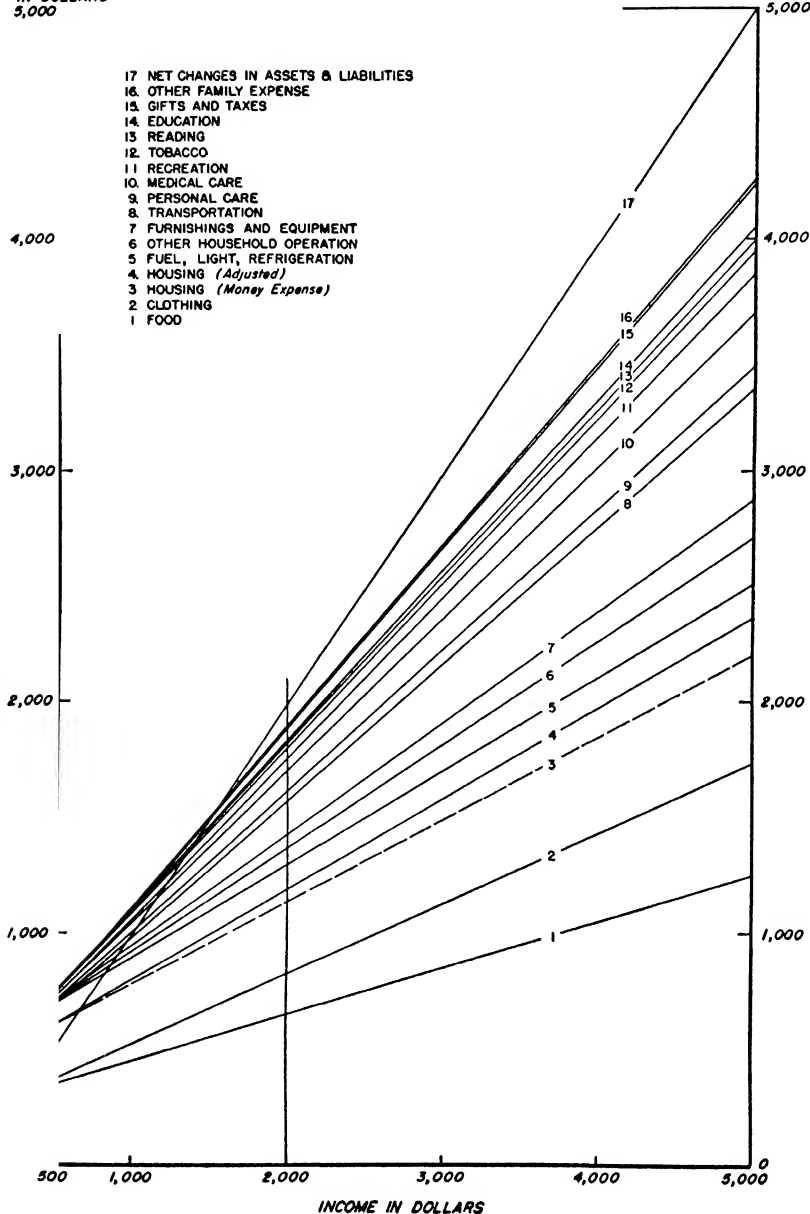


CHART II
EXPENDITURE PATTERN
WAGE - EARNER FAMILIES
DENVER, COLO. 1935-36

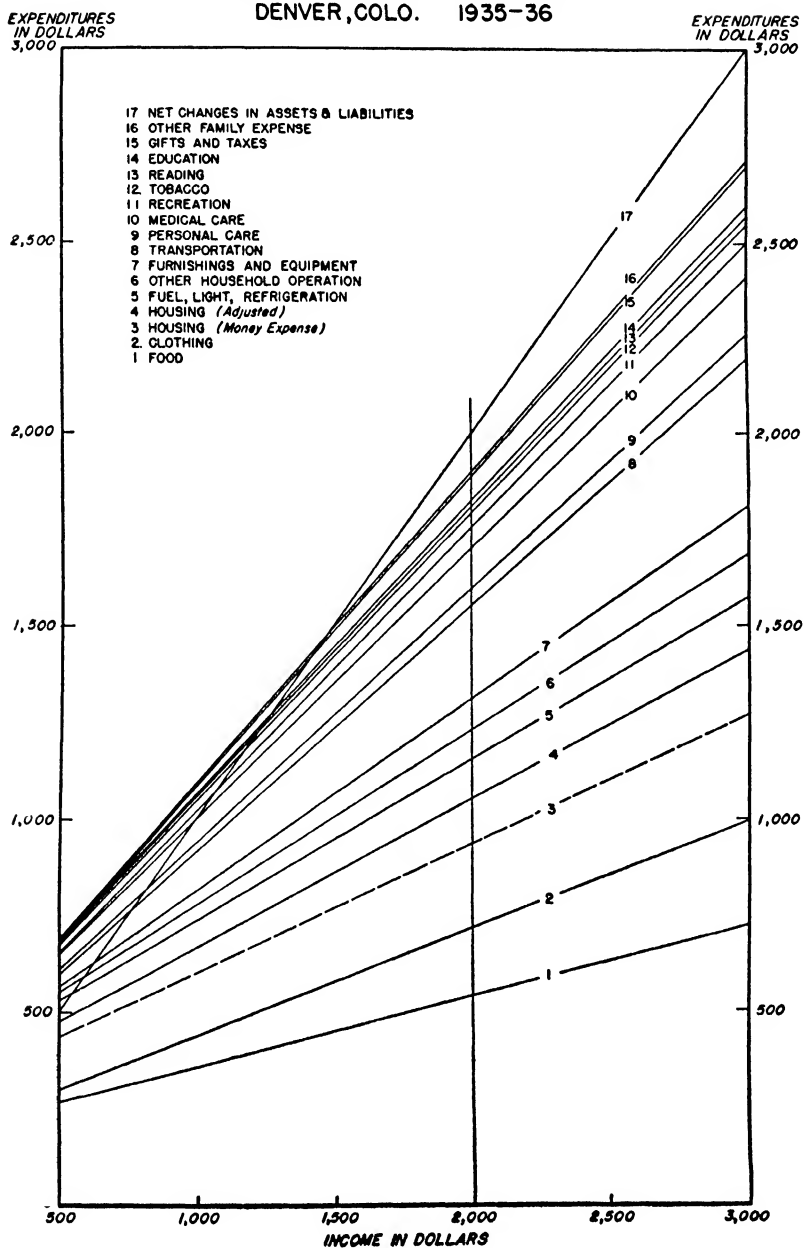


CHART IV
EXPENDITURE PATTERN EXTENDED TO ZERO INCOME
WAGE EARNER FAMILIES
DENVER, COLO 1935-36

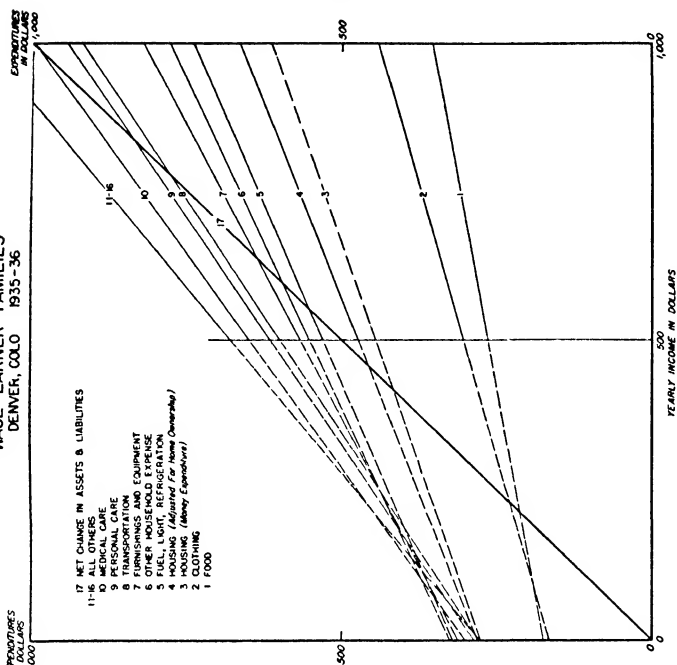
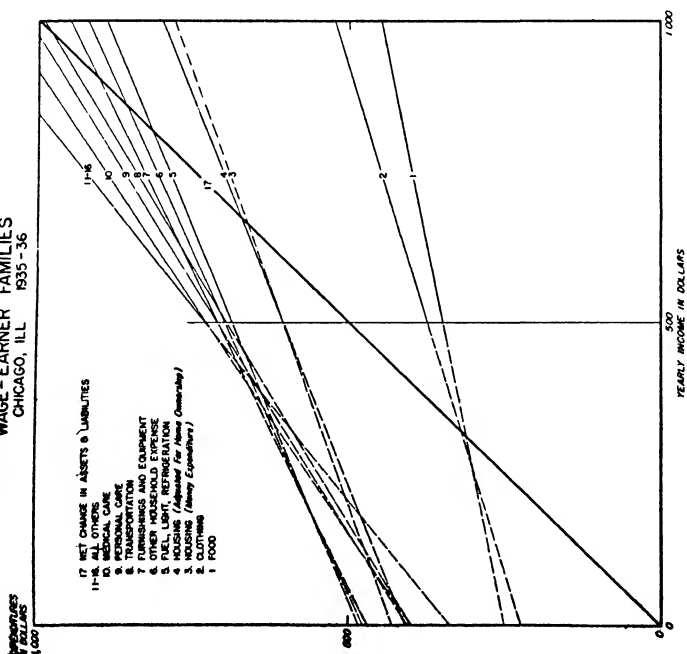


CHART III
EXPENDITURE PATTERN EXTENDED TO ZERO INCOME
WAGE-EARNER FAMILIES
CHICAGO, ILL. 1935-36



a vertical line is run up from the x axis, as is done in the illustrations at the \$2,000 income point, it will cut each of the layers so that the distances along the vertical line will measure the amount expended for the item of consumption included within the segment at that income level. We thus have at a glance the average expenditures for the main categories of consumption, distributed within the total income at any desired income level. The values are obtained from linear regressions applied to the original data. Such a linear representation of expenditures, which has been used with more limited samples by Allen and Bowley,³ reduces to a simple configuration the cumulative pattern of expenditure by consumption categories across the income range. It may serve, as will be later explained, to show not only the average amount of expenditures at a given level but also, by the slope of each line with respect to the one below it, the relative urgency and elasticity of expenditure for the different items. A reduction of the data to a conventional pattern of this type should be valuable, if valid, for ready comparison of the general expenditure patterns of different communities, occupations and family types. Let us now turn to consideration of the individual regression lines which make up this cumulative pattern.

The question which will naturally arise is whether we are justified in applying linear regressions uniformly to items of expenditure which may undergo varying changes in emphasis from one income level to another. If we take "necessity" items, will there not be a tendency for the expenditures to approach an asymptote at the high income levels? And in the case of luxuries, should we not expect the slope of the expenditure curve to become steeper as it reaches the income levels at which the desire for luxuries may be better satisfied? We need not argue the point that it would be indiscriminating to apply a uniform curve, much less a linear regression, to expenditures for specific items like bread and artichokes, overalls and swallow-tails, pots and portraits. But there is nevertheless the possibility of utilizing linear regressions for general classes of expenditures, as distinguished from the specific items purchased, and for presenting cumulative patterns of expenditure, as distinguished from the detailed examination of an isolated regression. The fit of the linear regression has been tested for each of the categories of expenditure shown in the charts of the cumulative expenditure patterns. The regression lines of four of these individual categories have been selected to illustrate some of the characteristic findings and may be examined separately by reference to Charts V, VI and VII.

³ Allen and Bowley, *Family Expenditure: A Study of Its Variations*, London, 1935

Regression equations were also applied by William F. Ogburn at an earlier date for correlating the per cent of income spent on a given item to the total income. See "Analysis of the Standard of Living in the District of Columbia in 1916," this JOURNAL, Vol. 16 (June 1919), pp 374-389.

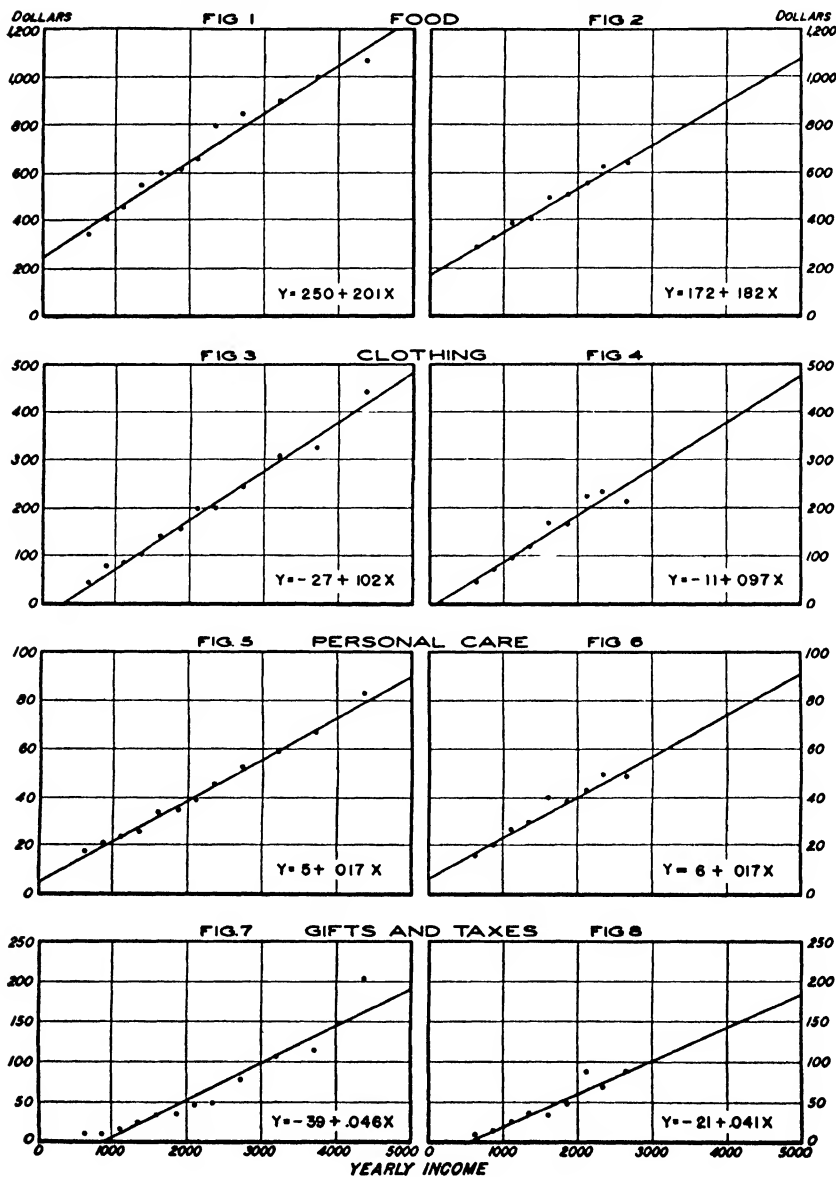
CHART V

STRAIGHT LINE FITTED TO AVERAGE EXPENDITURES
IN RELATION TO FAMILY INCOME

WAGE EARNER FAMILIES OF —

CHICAGO

DENVER



At the top of Chart V are plotted the average amounts of food expenditures at successive income levels for wage earner families in Chicago (upper left) and for the wage earner families in Denver (upper right). The data for the Chicago wage earner incomes run to \$5,000, while those for Denver wage earners stop at \$3,000. In the case of the Chicago families, it may be noted that at the upper end of the scale—above \$2,500—the slope of the plotted points is somewhat less steep than it is for the points below \$2,500. Between \$1,250 and \$2,000 there appears to be something of an intermediate plateau. In Denver, where wage levels generally run lower, there is little to choose, as to slope, between the upper and lower halves of the scale. Undoubtedly a factor in causing the plotted points to depart from the regular curve is the random fluctuation to be expected when we limit ourselves to a sample of approximately thirty families per income band (combining different family types) within the given occupation. It also appears likely that instead of a regular outline up the income scale, be it linear or non-linear, we shall find after closer study of the families scheduled that the discontinuity of the outline represents a significant “terracing” of expenditure, with a given plateau spreading over several income bands. In part these terraces may reflect a certain degree of social stratification within the span of two or more income intervals. Or a new plateau may be due to changes in the family type pattern, such as the increase, with given income level, of adult families containing supplementary earners.⁴

We meet with another situation which affects the utility of the linear regression, in the case of food expenditures plotted for the families of salaried business executives (Charts VI and VII). In their case, families are included with incomes from \$5,000 up. Taking the food curve for Chicago, it is apparent that we should get a very much better regression line if we stopped at the \$5,000 mark; we might possibly justify including families in the \$7,500 to \$10,000 income bracket. But the inclusion of the point for average expenditure of families having from \$10,000 upward imposes a severe downward influence upon the slope—sufficient to double the reading for the line at the intercept and materially to increase the impression of rigidity over the whole range of food expenditures. The extent of the change in slope for food expenditure due to the inclusion of the uppermost income bracket is shown by the broken line which takes in only the plotted points up to \$8,500. In the case of the salaried business families for Denver, where the mean income figure for the highest income group

⁴ Linear regressions for expenditure patterns with family type as a control were not completed in time for inclusion in the present paper.

CHART VI

**STRAIGHT LINE FITTED TO AVERAGE EXPENDITURES
IN RELATION TO FAMILY INCOME
SALARIED BUSINESS FAMILIES OF CHICAGO**

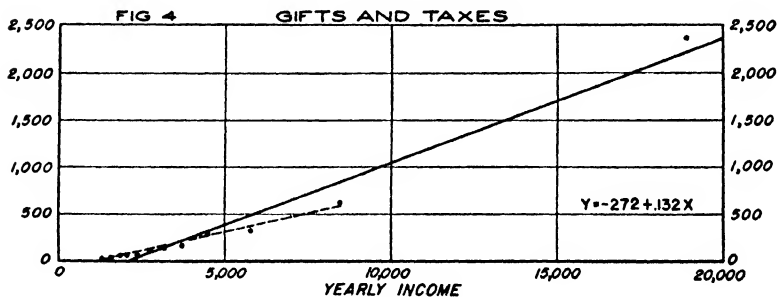
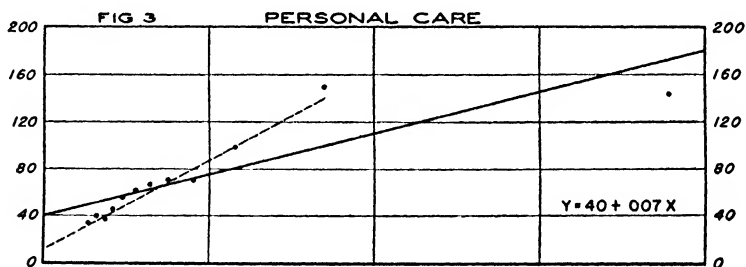
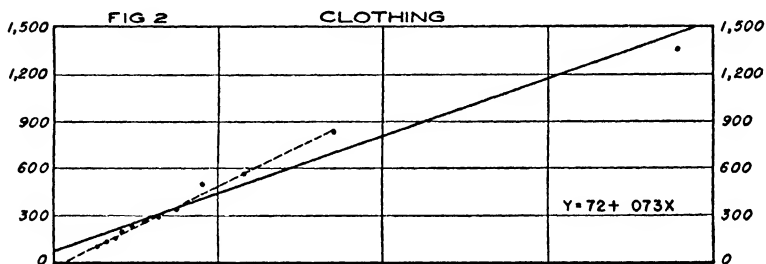
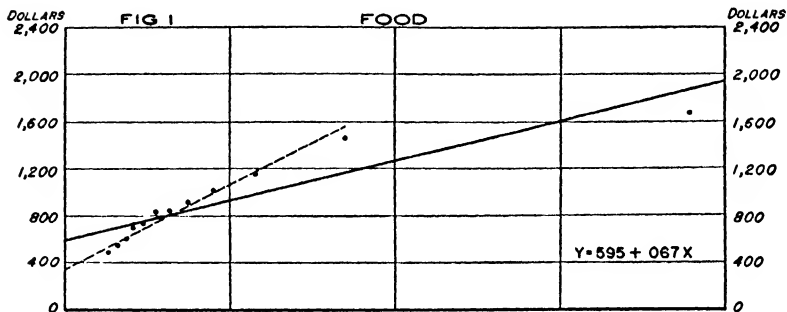


CHART VII

STRAIGHT LINE FITTED TO AVERAGE EXPENDITURES
IN RELATION TO FAMILY INCOME
SALARIED BUSINESS FAMILIES OF DENVER

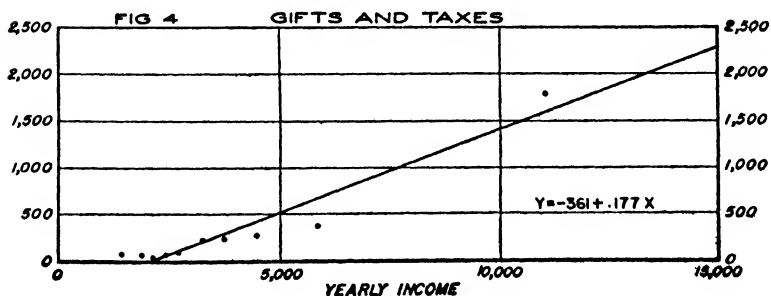
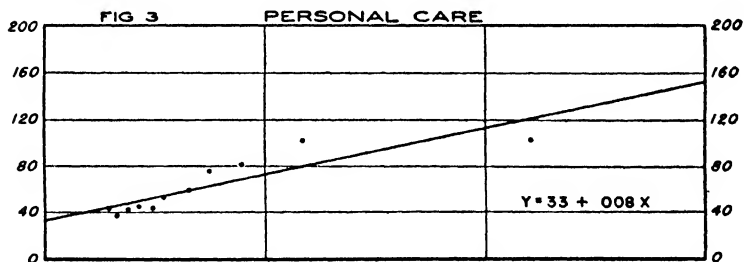
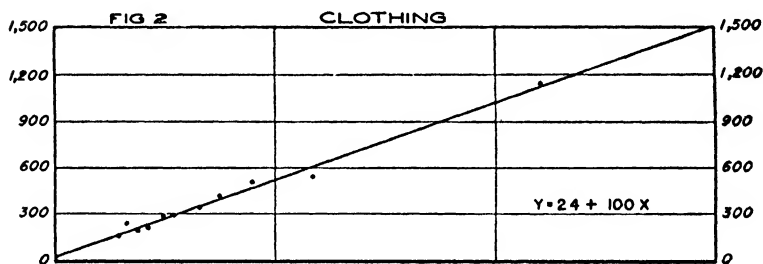
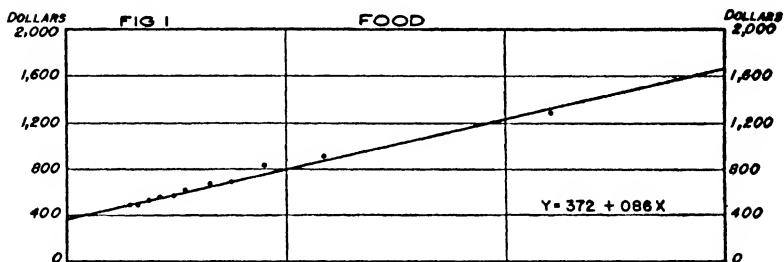


TABLE 3
EVALUATION OF LINEAR REGRESSION BY OCCUPATION—CHICAGO AND DENVER

Expenditure category	Linear plot		Non-linear plot		Salaried professional families		Salaried business families		Independent professional and business families		Independent business families		Clerical families		Wage earner families		Totals	
	y = linear plot		n = non-linear plot		c = linearity low but no evidence of non-linearity		b = good (or better) linear fit if highest income group is eliminated		b = good (or better) linear fit if highest income group is eliminated		b = good (or better) linear fit if highest income group is eliminated		b = good (or better) linear fit if highest income group is eliminated		b = good (or better) linear fit if highest income group is eliminated		b = good (or better) linear fit if highest income group is eliminated	
	Chicago	Denver	Chicago	Denver	Chicago	Denver	Chicago	Denver	Chicago	Denver	Chicago	Denver	Chicago	Denver	Chicago	Denver	$y+c$	b only
Food	n	nb	nb	y	n	y	nb	y	y	y	y	y	y	y	y	y	7	4
Clothing	y	y	b	y	y	y	b	y	y	y	y	y	y	y	y	y	10	0
Housing (adjusted)	y	y	b	y	y	y	b	y	y	y	y	y	y	y	y	y	9	0
Fuel, light, refrigeration	y	y	n	y	y	y	y	y	n	y	b	y	c	y	y	y	8	2
Other household operation	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	10	0
Furnishings, equipment	y	c	y	y	y	y	nb	y	y	y	y	y	y	y	y	y	7	4
Transportation	y	y	y	y	y	y	nb	y	y	y	y	y	y	y	y	y	8	3
Personal care	y	c	b	y	y	y	b	y	y	y	y	y	y	y	y	y	9	1
Medical care	c	c	c	y	c	y	y	y	y	y	y	y	y	y	y	y	11	0
Recreation	y	y	b	y	y	y	y	y	y	y	y	y	y	y	y	y	9	1
Tobacco	y	y	b	y	y	y	y	y	y	y	y	y	y	y	y	y	10	0
Reading	y	y	b	y	n	y	y	y	y	y	y	y	y	y	y	y	8	1
Education	c	n	y	y	y	y	y	y	y	y	y	y	y	y	y	y	6	5
Gifts and taxes	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	3	8
Savings	y	y	n	y	y	y	y	y	y	y	y	y	y	y	y	y	5	6
Totals $y+c$	13	11	4	12	12	12	4	12	10	7	14	10	13	14	120	—	—	—
n	2	4	4	3	3	3	4	5	5	5	1	5	2	1	—	35	—	—
b (only)	0	0	7	0	0	0	0	0	0	3	0	0	0	0	—	—	—	10

* Slight negative correlation

In general, linear correlations below .80 were classified as "c," but several above .80 with a relatively high standard of error were also classified as "c." In Denver, medical care for salaried business was so designated even though r was .86 ($S = 48$). In Chicago, housing for wage earners had a linear correlation coefficient of .80 but S was 42.

The linear correlation coefficient might be very high (.95 for example)

even when the points were clearly non-linear, due to the range of the data. Hence the magnitude of this coefficient was no index of the proper fit. In a few cases a linear equation fits the data very well, but a non-linear equation would have been slightly better.

For Chicago salaried business families, all the regressions classified as "b" were clearly linear except for the last point (\$19,000 income) which often gave an expenditure less than that expected on the basis of linearity.

is less than \$11,000, the effect of including the last point is decidedly less serious. Nevertheless, a steeper slope and a better fit are produced by limiting the incomes to \$5,000 (Figure 1, Charts VI and VII).

Turning to the figures on clothing for wage earner families, more than half of the points are virtually on the regression line for both cities (Figures 3 and 4, Chart V). The points that deviate may be assumed to do so because of random fluctuations, since the deviations are slight and not uniformly distributed. For the wider income span given to the salaried business families, clothing follows a linear rather than a non-linear outline up to the \$10,000 income band (Figure 2, Chart VI). The inclusion of the highest income bracket for Chicago reduces the slope for the Chicago sample, as compared with the one for Denver.

In respect to personal care, the wage earner expenditures seem to be better suited to linear regression than to a non-linear curve, although here again the terracing previously referred to is quite apparent, seeming to go in pairs of income bands. With salaried business families, both for Chicago and Denver, we get a fluctuating pattern (Figure 3 in Charts VI and VII). In the case of Chicago, a peak is reached with the \$7,500 to \$10,000 group; and in the case of Denver, it is reached with the \$5,000 to \$7,500 group. The inclusion of the top brackets is here obviously impracticable with linear regressions. The business and professional families do not exhibit the regularity in the stepping up of expenditures with income that is found in the case of wage earner and clerical families, or that is obtained when all occupational groups are combined.

As a last illustration, attention is directed to the figures for gifts and taxes (Figure 4 in Charts VI and VII). Here, regardless of occupation, the pattern is one with almost zero slope for the lower income brackets, stepping up very sharply with increase in income. Obviously a curve which emerges slowly from the horizontal, and increases the slope sharply with the rise in income above \$3,000, will be the only type with which to describe appropriately the item of gifts and taxes.

After inspection of the regression lines obtained from the plotting of the separate items for each of the occupational groups in the Chicago and Denver samples, a classification of their applicability to linear regressions has been worked out, as shown in Table 3. It will be noted that of the 165 separate regressions plotted, 120 were clearly linear or revealed no definite curvilinear trend; 10 examples indicated the feasibility of linear representation if the last point were omitted; while 35 were apparently curvilinear. This is to say that 73 per cent were linear, 6 per cent were linear except for the last income point, and 21 per cent indicated non-linearity.

Urgency of expenditure, intercept value. In their use of linear regressions, Allen and Bowley have laid emphasis on the magnitude and sign of the value obtained at the intercept, representing expenditure at zero income. Using the y axis for expenditures and the x axis for income, the line of regression for the expenditure on a given item would take the form $y = a + bx$, where a is the constant term for expenditure at the intercept, and b the constant for the slope of the line. If in this

TABLE 4
SCALE OF URGENCY OF EXPENDITURE CATEGORIES

CHICAGO		DENVER	
Wage Earner	Salaried busines	Wage earner	Salaried business
1. Food	Food	Food	Food
2. Housing (money exp)	Housing (adjusted)	Housing (adjusted)	Housing (adjusted)
3. Housing (adjusted)	Housing (money exp)	Housing (money exp)	Housing (money exp)
4. Fuel, light, refrigera- tion	Transportation	Fuel, light, refrigera- tion	Fuel, light, refrigera- tion
5. Reading	Medical care	Medical care	Medical care
6. Personal care	Clothing	Tobacco	Personal care
7. Tobacco	Fuel, light, refrigera- tion	Reading*	Tobacco
8. Furnishings, equip- ment	Recreation	Personal care*	Clothing
9. Medical care	Tobacco	Other household oper- ation	Reading
10. Other household oper- ation	Personal care	Education	Education
11. Education	Other household oper- ation	Furnishings, equip- ment	Recreation
12. Recreation	Reading*	Clothing	Other household oper- ation
13. Clothing	Furnishings, equip- ment	Recreation	Transportation
14. Gifts and taxes	Education	Gifts and taxes	Furnishings, equip- ment
15. Transportation	Gifts and taxes	Transportation	Savings
16. Savings	Savings	Savings	Gifts and taxes

* Tied ranks.

expression the amount obtained for a is positive, the expenditure item is assumed to rank as a necessity, the degree of urgency depending upon the magnitude of the a value. If the value of a is negative, the item is assumed to have the character of what under Engel's law would be deemed a luxury. The constant term b , representing the slope of the line, when taken in conjunction with a , determines the elasticity of the expenditure for the item at a selected income level. For a given value of b , we shall have greater rigidity in the expenditure if a is high and positive; conversely, we shall have a high elasticity of expenditure if a is decidedly negative.⁵ On that basis, a scale of urgency

⁵ While a detailed discussion of the concept of elasticity of expenditure would carry beyond the practicable limits of the present paper, it may be noted here that elasticity of expenditure for any

is built up, ranging from the highest positive intercept value—such as we should get for food—to the largest corresponding minus quantity—such as we should get if we attempted a linear regression for expenditures on gifts and taxes. By applying this type of yardstick to the data used for illustration, we get an order of urgency for wage earner and salaried business families, as shown in Table 4. In Tables 5 and 6 are given the computed values for the intercept a , the constant term b representing the slope, and the value derived for

TABLE 5
LINEAR REGRESSION CONSTANTS FOR EXPENDITURES BY INCOME FOR WAGE
EARNER AND SALARIED BUSINESS FAMILIES: CHICAGO

Expenditure category	Wage earner families			Salaried business families		
	Intercept A	Slope B	Expenditure elasticity at the mean	Intercept A	Slope B	Expenditure elasticity at the mean
Food	\$249	.201	.636	\$595	.067	.347
Clothing	— 27	.102	1.140	72	.073	.827
Housing (money expense)	207	.050	.344	305	.073	.532
Housing (adjusted)	186	.087	.503	315	.086	.562
Fuel, light, refrigeration	74	.018	.350	65	.010	.410
Other household operation	— 9	.040	1.116	30	.049	.884
Furnishings, equipment	— 5	.033	1.075	21	.016	.782
Transportation	— 70	.112	1.402	93	.058	.748
Personal care	5	.017	.884	40	.007	.444
Medical care	— 6	.048	1.064	91	.010	.350
Recreation	— 23	.038	1.386	50	.021	.663
Tobacco	4	.019	.908	44	.004	.318
Reading	7	.006	.658	21	.003	.426
Education	— 11	.013	1.624	— 2	.010	1.048
Gifts and taxes	— 39	.046	1.648	— 272	.132	1.776
Savings	—337	.216	3.549	—1155	.449	2.197
Total expenditure	357	.747	.820	1145	.538	.717

elasticity of expenditure (η) at the mean income. In the case of food for Chicago wage earners, to take an illustration, the expenditure value

item, taken at a given income, is the ratio of the per cent increase in expenditure to the per cent increase in income. Expressed as an equation, the elasticity of expenditure

$$\eta = \frac{\Delta e/e}{\Delta i/i} = \frac{\Delta e}{\Delta i} \cdot \frac{i}{e} = \frac{b}{p}$$

where i is the income

Δi is the increase in income

e is the expenditure corresponding to i

Δe is the increase in expenditure corresponding to Δi

The term $\Delta e/\Delta i$ is the slope of the linear regression line, usually written b ; while $i/e = 1/p$ since $e/i = p$, the percentage which the expenditure is of the corresponding income

Relationship between a , the intercept; b , the slope; and p , the percentage expenditure is of income.

If $y = a + bx$, then $p = (a/x) + b$. From the fact that $\eta = b/p$ we derive $\eta = bx/(a + bx)$. This equation shows that when a is positive, (1), η is less than 1; when a is zero, (2), η is equal to 1; and when a is negative, (3), η is greater than 1. (For this latter condition bx must be greater than a ; and b is assumed throughout to be positive—which represents the usual situation.)

at any given income is \$249.50 plus 20.1 per cent of the income (Figure 1, Chart V).

Interpretation of cumulative linear pattern. To return to our cumulative expenditure Charts I and II, we may now view these as total expenditure patterns built up by the use of linear regressions computed (as in Tables 5 and 6) from the data for the various categories of consumption. Several of these lines approach, or may cross, the lines marking the items immediately below them, before reaching the lowest income point. This is equivalent to their having a negative intercept

TABLE 6
LINEAR REGRESSION CONSTANTS FOR EXPENDITURES BY INCOME FOR WAGE
EARNER AND SALARIED BUSINESS FAMILIES DENVER

Expenditure category	Wage earner families			Salaried business families		
	Intercept A	Slope B	Expenditure elasticity at the mean	Intercept A	Slope B	Expenditure elasticity at the mean
Food	\$172	182	633	\$372	086	461
Clothing	- 11	097	1 072	24	100	939
Housing (money expense)	111	.054	.440	253	037	348
Housing (adjusted)	116	107	600	257	085	549
Fuel, light, refrigeration	41	033	563	92	017	405
Other household operation	1	037	990	- 38	061	1 205
Furnishings, equipment	- 10	045	1 156	- 57	048	1 478
Transportation	- 33	138	1 172	- 39	124	1 094
Personal care	6	017	816	33	.008	.466
Medical care	15	045	.826	69	.031	621
Recreation	- 13	036	1 278	-28	046	1 203
Tobacco	12	010	563	31	003	.273
Reading	6	005	.559	11	004	578
Education	- 6	011	1 511	- 16	014	1 410
Gifts and taxes	- 21	041	1 467	-361	177	2 243
Savings	-277	192	8 596	-352	.190	2 011
Total expenditure	272	755	819	348	762	.890

value. It means that the items which thus cease to have a definite slice of the expenditure total would be classified in the non-urgent group of expenditures, having a high degree of "Engelian elasticity." In order that these regression lines at very low incomes may be more readily traced to their respective intercepts, they are shown with the scale for the x and y axes exaggerated, in Charts III and IV, "Patterns Extended to the Zero Income;" the last six minor categories of the cumulative Charts I and II are also combined in III and IV to clarify the picture. The broken lines represent the extrapolation from the lowest incomes actually scheduled, to zero income. It will be noted that the total income line (marked 17) runs through the area of ex-

penditures as it gets into the lowest incomes, indicating the excess of expenditures over current income at those levels of income.

Some of the applications which we make of these cumulative patterns, for a comparison of family expenditures by income, are apparent. Comparing the wage earner families of Chicago and Denver (Charts III and IV), for example, we may see that food has taken a larger percentage of total income from the low income families in Chicago than it has from those in Denver. Housing, likewise, is shown to require more of the low family income in Chicago than in Denver. Indeed, food plus housing appear as alone sufficient to produce a net deficit for Chicago wage earner families with incomes between \$500 and \$750, while for the Denver wage earner families, the regressions at \$500 to \$750 income allow for food, housing, and clothing, with a little to spare. The clothing expenditures in the Chicago pattern are seen to be substantially less for the wage earner families of low income than they are in Denver. These primary elements in the total expenditure pattern immediately account for the higher money wages required by Chicago families than by Denver families. Transportation, in part reflecting the ownership of an automobile, is relatively as important as clothing in its claim in the family budget in Denver, but less conspicuous in Chicago. It will be seen how the other items in the family budget, notably household operations, medical care, and recreation, tend to approach zero expenditures at the low income levels for Chicago wage earners, causing the regression lines to cross or blend into each other from \$1,000 down. For both Chicago and Denver, however, clothing takes on the pattern of an item with luxury characteristics, showing a negative intercept in both cities at zero income.⁶ Personal care holds its place as a necessity among the families in both Chicago and Denver, although the item is not a large one. Another interesting feature among the minor items is the continuance of reading as a positive item in the budget almost to the intercept. In the case of the wage earner families it actually has a positive value at zero income.⁷

⁶ On the charts for the salaried business families, for which space is not available in this paper, a number of items show the characteristic of necessities, at the intercept, which appear as luxuries in the wage earner charts. Thus clothing has a positive intercept for the salaried business families in both cities, whereas the intercepts were negative for the wage earner group. Because of the larger incomes that prevail, the investment in owned homes (*housing adjusted*, on the charts) remains a positive item at the intercept for the salaried business families.

⁷ On the cumulative expenditure charts the area between the regression line labelled "net change in assets and liabilities" (shown as 17), and the line of total expenditure, represents the difference between the current year's expenditures for consumption goods and the current net income. Increases in assets and decreases in liabilities tend to give this net-change item a positive value; decreases in assets and increases in liabilities tend to make it negative. Life insurance premiums and other additions to savings, as well as repayments of debts, represent disbursements which increase assets. Unpaid bills,

Conclusion. A few tentative conclusions may be drawn from the experimentations done thus far, regarding the practicability of linear regressions for use in the measurement of family expenditures. Although the straight line is inapplicable to many specific items of consumption, it is useful in highlighting the behavior of the main categories of expenditure. This seems to be true in general, even though among the groups of expenditures there are individual cases which deviate from the regression line to an extent that renders them unamenable to linear representation.

The linear regression appears to be especially promising in the construction of cumulative expenditure patterns, permitting broad comparisons between different categories of expenditure within a given universe and between the total expenditures of different universes. Extrapolation of the regression lines for incomes beyond the main body of the data is not feasible. Above \$5,000 of income, the slope of the line is subject to serious distortion because of the excessive influence of the few families which set the average for the extremely high incomes. Bearing these limitations in mind, the linear regression may serve as a convenient guide in rating expenditures on the basis of urgency, as well as in the comparison of one sample with another. Its relative simplicity commends it for rough approximations even though it is found necessary to apply other curves which will better fit the characteristics of specific items of expenditure.

and dipping into savings for expenditures beyond current income, would bring down the values for the net-change line. Special note should be taken of the fact that the schedules were taken in 1936—a year of recovery, in which some of the vacuum left by depression years in purchases of durable consumption goods was filled in with forward buying, on installment accounts. This forward buying increases the apparent family deficit in the expenditure pattern shown, which is for the year 1936. The total amount of an installment purchase made during the year was charged to the family, even though payments might not be due until after the schedule year. Inasmuch as the paying off on installment accounts incurred in previous years was not as great as the forward buying, a net deficit is shown by the regression line at relatively high income levels; this may be taken to reflect optimism as to the future, rather than insolvency on the part of the families in the sample.

CONTRIBUTION TO THE THEORY OF SAMPLING HUMAN POPULATIONS

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1 INTRODUCTION

AT A CONFERENCE on Sampling Human Populations held last April at the Department of Agriculture Graduate School in Washington, a problem was presented by Mr. Milton Friedman and Dr. Sidney Wilcox for which I could not offer a solution at the time. Since it seemed to be important and of general interest, I have considered it in some detail. The purpose of this paper is to present the results I have obtained.

2 STATEMENT OF THE PROBLEM

I shall start by describing the problem in much the same form as it was stated to me, without using any mathematical symbols. Then I shall formulate it in mathematical terms. The reader who does not wish to follow the mathematical processes may skip from equation (8) to the results and examples beginning with equation (52) on page 111.

A field survey is to be undertaken to determine the average value of some character of a population, for example, the amount of money which families spend for food in a population of families residing in a certain district. The collection of these data requires long interviews by specially trained enumerators and, hence, the cost per family is quite high. Since the total cost of the survey must be held within the amount appropriated for it, the data must be secured from a small sample of the population. In view of the great variability of the character, the sample appears to be too small to yield an estimate of the desired degree of accuracy.

Now the character is correlated with a second character which can be determined much more readily and at a low cost per family. Since a very accurate estimate of the second character can be secured at relatively small expense, and since for any given value of it, the variation of the original character will be smaller than it is in the whole population, a more accurate estimate of the original character may be obtained for the same total expenditure by arranging the sampling of the population in two steps. The first step is to secure data, for the second character only, from a relatively large random sample of the population in order to obtain an accurate estimate of the distribution of this character. The second step is to divide this sample, as in

stratified sampling, into classes or strata according to the value of the second character and to draw at random from each of the strata a small sample for the costly intensive interviewing necessary to secure data regarding the first character.

An estimate of the first character based on these samples may be more accurate than one based on an equally expensive sample drawn at random without stratification. The question is to determine for a given expenditure, the sizes of the initial sample and the subsequent samples which yield the most accurate estimate of the first character.

Let us now enter into the details and introduce the necessary notation. Denote by π the population studied and by X the character of its individuals the average of which, say \bar{X} , is to be estimated. This is the character the collection of data on which is costly. Next let Y denote the second character, on which the collection of data is cheap, and which is assumed to be correlated with X . The range of variation of Y in π being more or less known, we shall divide it into s intervals, say

$$(1) \quad \text{from } Y_0 \text{ to } Y_1, \text{ from } Y_1 \text{ to } Y_2, \dots, \text{ and from } Y_{s-1} \text{ to } Y_s.$$

Denote by π_i the part of the population π composed of the individuals for which

$$(2) \quad Y_{i-1} \leq Y < Y_i, \quad (i = 1, 2, \dots, s);$$

π_i will be called the i th stratum of the population π . Denote further by

$$(3) \quad p_1, p_2, \dots, p_s$$

the proportions of the individuals of π belonging to the strata $\pi_1, \pi_2, \dots, \pi_s$ respectively.

In the following we shall have to consider three different processes of sampling which it is important to distinguish. The first two form the method described by Mr. Friedman and Dr. Wilcox, which I shall further describe as the method of double sampling. The third will serve as a standard of comparison of the accuracy of the method of double sampling. In order to avoid any misunderstanding let us describe all three in detail.

The method of double sampling consists of the following steps:

(i) Out of the population π we select at random N individuals and ascertain for them the values of the character Y . This sample will be denoted by S_1 . The sample S_1 is meant to estimate the proportions p_i .

(ii) Now we proceed to sample the strata π , and this is the second of the sampling processes mentioned. Out of each stratum π , we select at random m_i individuals which form a sample to be denoted by $S_{2,i}$, and ascertain for each of these individuals, the value of the character X . The samples $S_{2,i}$ serve to estimate the mean value of X in each of the strata π_i . These estimates and the estimates of the proportions (3) obtained previously from the sample S_1 , permits us to estimate the grand mean \bar{X} .

The combination of (i) and (ii) forms the method of double sampling. Denote by m_0 the sum of the sizes m_i of all the samples $S_{2,i}$, so that

$$(4) \quad m_0 = \sum_{i=1}^k m_i$$

and by A and B the costs of ascertaining for one individual the value of X and that of Y respectively. Finally, let C denote the total amount of money available for the collection of data. Then the numbers m_0 and N must be subject to the restriction

$$(5) \quad Am_0 + BN = C.$$

We shall consider what values of m_i , m_0 and N , satisfy the conditions (4) and (5), yield the greatest accuracy in estimating the mean value of X by the method of double sampling. This accuracy will then be compared with that attainable in the ordinary way, that is without the application of the method of double sampling. For this purpose we shall consider a third sampling process by which all the funds C available are spent on selecting at random a number, say M , of the elements of π and in ascertaining for each of them the value of X . Denote this third sample by S_0 . Its size will have to be $M = C/A$. In order to get an idea of the utility of the method of double sampling we shall compare its accuracy with that of the ordinary mean value of X calculated from the sample S_0 .

3 FIRST METHOD OF APPROACH

In the present paper¹ we shall make no assumption as to the character of the regression of X on Y in the population π . Denote by X_1, X_2, \dots, X_k , the mean values of X in each of the strata. It follows that the grand mean of X which is to be estimated is

$$(6) \quad \bar{X} = \sum_{i=1}^k p_i X_i.$$

¹ The same problem, under the assumption that the regression of X on Y has a certain known form, forming the second method of approach, will be considered in a later paper.

Further denote by σ_i the standard deviation of X within the i th stratum.

Denote by n_i the number of individuals drawn in the first sample S_1 which fall within the i th stratum and introduce

$$(7) \quad r_i = n_i/N.$$

Let x_{ij} denote the value of X of the j th individual drawn from the i th stratum to form the sample $S_{2,i}$. Put

$$(8) \quad x_i = \frac{1}{m_i} \sum_{j=1}^{m_i} x_{ij}.$$

We shall start by considering what function F_1 of the observations, namely of the numbers (7) and of

$$(9) \quad x_{i1}, x_{i2}, \dots, x_{im_i} \quad \text{for} \quad i = 1, 2, \dots, s$$

would be suitable as an estimate of (6). We shall limit our considerations to homogeneous functions of second order, of the form

$$(10) \quad F_1 = \sum_{i=1}^s \sum_{j=1}^s \sum_{k=1}^{m_j} \lambda_{ijk} r_i x_{jk}$$

where λ_{ijk} is a constant coefficient. Out of all such functions we shall select and term the best unbiased estimate of \bar{X} , the one which has the following properties:

- (i) The mathematical expectation of F_1 is identically equal to \bar{X} .
- (ii) The variance of F_1 is smaller than that of any other function of the form (10) having the property (i).

Denoting by $\mathcal{E}(u)$ the mathematical expectation of any variable u , we may rewrite (i) in the following form.

$$(11) \quad \mathcal{E}(F_1) \equiv \sum_{i=1}^s \sum_{j=1}^s \sum_{k=1}^{m_j} \lambda_{ijk} \mathcal{E}(r_i x_{jk}) \equiv \sum_{i=1}^s p_i X_i.$$

When calculating expectations, we shall use the assumption that the population π and all of its strata are so large compared to the sample drawn that the particular drawings can be considered as mutually independent. We shall notice further that, in spite of the fact that the samples $S_{2,i}$ probably will be drawn out of the sample S_1 and not directly from the strata π_i , the variable x_{jk} is independent of r_i . This follows from the circumstance that when we draw the first

sample S_1 , we do so without any consideration of the values of X . It follows that

$$(12) \quad \mathcal{E}(r, x_{jk}) = \mathcal{E}(r_i) \mathcal{E}(x_{jk}) = p_i X_j.$$

Substituting (12) in (11) and rearranging, we have

$$(13) \quad \sum_{i=1}^s p_i \left(\sum_{j=1}^s X_j, \sum_{k=1}^{m_j} \lambda_{i,jk} - X_i \right) \equiv 0.$$

The necessary and sufficient condition for this equality to hold good identically, that is to say, whatever the unknown proportions p_1, p_2, \dots, p_s may be, is that the coefficients of the p_i vanish, i.e.

$$(14) \quad \sum_{j=1}^s X_j, \sum_{k=1}^{m_j} \lambda_{i,jk} - X_i \equiv 0 \quad \text{for} \quad i = 1, 2, \dots, s.$$

As we do not know the values of the X_j , these equalities should again hold good identically, that is to say, whatever the values of the X_j . The equation (14) can be rewritten in the form

$$(15) \quad \sum_{j=1}^{i-1} X_j, \sum_{k=1}^{m_j} \lambda_{i,jk} + X_i \left(\sum_{k=1}^{m_i} \lambda_{i,ik} - 1 \right) + \sum_{j=i+1}^s X_j, \sum_{k=1}^{m_j} \lambda_{i,jk} \equiv 0$$

and its identical fulfilment is easily seen to require that

$$(16) \quad \begin{aligned} \sum_{k=1}^{m_j} \lambda_{i,jk} &= 0 & \text{for any} & \quad j \neq i; i, j = 1, 2, \dots, s & \quad \text{and} \\ \sum_{k=1}^{m_i} \lambda_{i,ik} &= 1 & \text{for} & \quad i = 1, 2, \dots, s. \end{aligned}$$

Equations (16) express the necessary and sufficient conditions for the function F_1 to be unbiased, considered as an estimate of \bar{X} . Obviously, there is an infinite number of systems of coefficients $\lambda_{i,jk}$ satisfying (16) and therefore an infinity of unbiased estimates of \bar{X} of the form (10). We shall now determine the one that we agreed to call the "best," i.e., that which has the smallest possible variance. Let us assume that the values of the $\lambda_{i,jk}$ are fixed somehow satisfying the conditions (16) and calculate the variance of F_1 . Denoting it by V_1 we shall have, owing to (6)

$$(17) \quad \begin{aligned} V_1 &= \mathcal{E}(F_1 - \bar{X})^2 \\ &= \mathcal{E} \left(\sum_{i=1}^s (r_i \xi_i - p_i X_i) \right)^2 \end{aligned}$$

where

$$(18) \quad \xi_i = \sum_{j=1}^s \sum_{k=1}^{m_j} \lambda_{ijk} x_{jk}$$

is again independent of r_i . We have further

$$(19) \quad \begin{aligned} V_1 &= \sum_{i=1}^s \mathcal{E}((r_i \xi_i - p_i X_i)^2) \\ &+ 2 \sum_{i=1}^{s-1} \sum_{h=i+1}^s \mathcal{E}\{(r_i \xi_i - p_i X_i)(r_h \xi_h - p_h X_h)\}. \end{aligned}$$

But

$$(20) \quad \begin{aligned} \mathcal{E}(r_i \xi_i - p_i X_i)^2 &= \mathcal{E}\{(r_i - p_i)\xi_i + p_i(\xi_i - X_i)\}^2 \\ &= \mathcal{E}((r_i - p_i)^2 \xi_i^2) + 2p_i \mathcal{E}\{(r_i - p_i)(\xi_i^2 - X_i \xi_i)\} \\ &\quad + p_i^2 \mathcal{E}\{(\xi_i - X_i)^2\} \\ &= \mathcal{E}\{(r_i - p_i)^2\} \mathcal{E}(\xi_i^2) + p_i^2 \mathcal{E}\{(\xi_i - X_i)^2\} \end{aligned}$$

owing to the independence of ξ_i and r_i and to the fact that $\mathcal{E}(r_i) = p_i$. Now it is known that

$$(21) \quad \mathcal{E}\{(r_i - p_i)^2\} = \mathcal{E}(r_i^2) - p_i^2 = p_i q_i / N$$

with $q_i = 1 - p_i$. Since²

$$(22) \quad \mathcal{E}\{(\xi_i - X_i)^2\} = \mathcal{E}(\xi_i^2) - X_i^2,$$

to calculate (20) it will be sufficient to calculate $\mathcal{E}\{(\xi_i - X_i)^2\}$ or the variance of ξ_i . Applying the usual formula for the variance of a linear function of independent variables and remembering that the variance of x_{jk} is denoted by σ_j^2 , we have

$$(23) \quad \mathcal{E}\{(\xi_i - X_i)^2\} = \sum_{j=1}^s \sigma_j^2 \sum_{k=1}^{m_j} \lambda_{ijk}^2.$$

It follows that

$$(24) \quad \begin{aligned} \mathcal{E}\{(r_i \xi_i - p_i X_i)^2\} &= \frac{p_i q_i}{N} \left(\sum_{j=1}^s \sigma_j^2 \sum_{k=1}^{m_j} \lambda_{ijk}^2 + X_i^2 \right) \\ &+ p_i^2 \sum_{j=1}^s \sigma_j^2 \sum_{k=1}^{m_j} \lambda_{ijk}^2. \end{aligned}$$

² Owing to (16) the expectation of ξ_i is obviously equal to X_i .

We may now go on and calculate the expectation of the other type of term in (19). We have

$$(25) \quad \begin{aligned} \mathcal{E}\{(r, \xi, -p, X_i)(r_h \xi_h - p_h X_h)\} &= \mathcal{E}(r, r_h \xi, \xi_h) - p, p_h X_i, X_h \\ &= \mathcal{E}(r, r_h) \mathcal{E}(\xi, \xi_h) - p, p_h X_i, X_h \end{aligned}$$

again owing to the independence of ξ , and r . It is known that

$$(26) \quad \mathcal{E}(r, r_h) = p, p_h \left(1 - \frac{1}{N}\right).$$

Further

$$(27) \quad \mathcal{E}(\xi, \xi_h) = \mathcal{E}\left\{\sum_{j=1}^s \sum_{k=1}^{m_j} \lambda_{j,k} x_{jk} \sum_{g=1}^s \sum_{u=1}^{m_g} \lambda_{h,g} x_{gu}\right\}.$$

Remembering that

$$(28) \quad \mathcal{E}(x_{jk}) = X_j \quad \text{and} \quad \mathcal{E}(x_{jk}^2) = \sigma_j^2 + X_j^2$$

and that the x , are assumed to be mutually independent, we have

$$(29) \quad \mathcal{E}(\xi, \xi_h) = \sum_{j=1}^s \sigma_j^2 \sum_{k=1}^{m_j} \lambda_{j,k} \lambda_{h,k} + \left(\sum_{j=1}^s X_j \sum_{k=1}^{m_j} \lambda_{j,k}\right) \left(\sum_{g=1}^s X_g \sum_{u=1}^{m_g} \lambda_{h,g} \lambda_{gu}\right)$$

Until the present moment we have not used the conditions (16) for the unbiased character of the estimate F_1 . Therefore the formula for the variance V_1 which we could obtain by substituting (24), (25), (26) and (29) into (19) would be perfectly general. We shall use it in our second method of approach. Now however we shall simplify (29) by substituting (16). We have

$$(30) \quad \mathcal{E}(\xi, \xi_h) = \sum_{j=1}^s \sigma_j^2 \sum_{k=1}^{m_j} \lambda_{j,k} \lambda_{h,k} + X_i X_h.$$

Now

$$(31) \quad \begin{aligned} V_1 &= \sum_{i=1}^s \left(p_i^2 + \frac{p_i q_i}{N}\right) \sum_{j=1}^s \sigma_j^2 \sum_{k=1}^{m_j} \lambda_{i,j,k}^2 + \sum_{i=1}^s \frac{p_i q_i}{N} X_i^2 \\ &+ \frac{2}{N} \sum_{i=1}^{s-1} \sum_{h=i+1}^s p_i p_h \left\{ (N-1) \sum_{j=1}^s \sigma_j^2 \sum_{k=1}^{m_j} \lambda_{i,j,k} \lambda_{h,j,k} - X_i X_h \right\}. \end{aligned}$$

Without attempting to simplify this expression at the present stage, let us select the $\lambda_{i,j,k}$ so as to minimize (31) while keeping the relations

(16) satisfied. For this purpose we will differentiate with respect to $\lambda_{i,k}$ the expression

$$(32) \quad f = V_1 - 2 \sum_{i=1}^s \sum_{j=1}^s \alpha_{ij} \sum_{k=1}^{m_j} \lambda_{i,k}$$

where the α_{ij} are Lagrange arbitrary multipliers, and equate the derivatives to zero. After some rearrangement, we get the following equation:

$$(33) \quad \frac{1}{N} p_{i,\sigma_i}{}^2 \left(\lambda_{i,k} + (N-1) \sum_{h=1}^s p_h \lambda_{h,k} \right) = \alpha_{ij}.$$

Summing both sides with respect to k from zero to m_j and taking into account (16), we get

$$(34) \quad \frac{N-1}{N} p_i p_{i,\sigma_i}{}^2 = m_j \alpha_{ij} \quad \text{for} \quad i \neq j$$

$$\frac{1}{N} p_{i,\sigma_i} (1 + (N-1)p_i) = m_j \alpha_{ij}.$$

Substituting these results in (33), we obtain

$$(35) \quad \lambda_{i,k} = \frac{N-1}{m_j} p_i - (N-1) \sum_{h=1}^s p_h \lambda_{h,k} = \lambda_{j,k} \quad (\text{say})$$

$$(36) \quad \lambda_{j,k} = \lambda_{i,k} + 1/m_j.$$

Substituting in (35) the values of $\lambda_{h,k}$ thus obtained, we easily get

$$(37) \quad \lambda_{i,k} = \lambda_{j,k} = 0 \quad \text{for} \quad i \neq j$$

$$\lambda_{j,k} = 1/m_j.$$

Substituting these values into (10) we obtain the following expression for the best unbiased estimate of \bar{X} :

$$(38) \quad F_1 = \sum_{i=1}^s r_i x_i.$$

The formula for the variance, V_1 , of F_1 is obtained by substituting (37) in (31)

$$(39) \quad V_1 = \sum_{i=1}^s \left\{ \left(p_i^2 + \frac{p_i q_i}{N} \right) \frac{\sigma_i^2}{m_i} + \frac{p_i q_i}{N} X_i^2 \right\} - \frac{2}{N} \sum_{i=1}^{s-1} \sum_{j=i+1}^s p_i p_j X_i X_j$$

which immediately reduces to the following form most convenient for

finding the system of values of N and the m_i that assure the greatest accuracy is estimating \bar{X} :

$$\begin{aligned}
 (40) \quad V_1 = & \frac{1}{m_0} \left(\sum_{i=1}^s \sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}} \right)^2 \\
 & + \sum_{i=1}^s m_i \left(\frac{\sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}}}{m_i} - \frac{\sum_{i=1}^s \sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}}}{m_0} \right)^2 \\
 & + \frac{1}{N} \sum_{i=1}^s p_i (X_i - \bar{X})^2.
 \end{aligned}$$

It is seen that none of the three terms in the right hand side can be negative. There is only one term which depends directly on m_1, m_2, \dots, m_s , namely the second, the others being dependent on $m_0 = \sum_{i=1}^s m_i$ and on N . It follows that once N and m_0 are fixed in one way or another the value of V_1 depends on the m_i and the value they ascribe to the second term. It is easily seen that its minimum value is zero and that this is attained, whenever for each value of $i=1, 2, \dots, s$

$$(41) \quad m_i = m_0 \sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}} / \sum \sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}}.$$

Owing to the fact that the m_i are integers, this ideal seldom can be attained exactly, but it may be approached as far as possible. We shall further assume that the m_i are selected in closest agreement with (41) and that the second term in (40) is negligible compared with the remaining two.

We must now consider what values of m_0 and N satisfying (5) are likely to give the smallest value to the sum of only two terms in (40), say

$$(42) \quad V'_1 = \frac{1}{m_0} \left(\sum_{i=1}^s \sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}} \right)^2 + \frac{1}{N} \sum_{i=1}^s p_i (X_i - \bar{X})^2.$$

Owing to the complex structure of the first of these terms, an accurate solution of the problem is difficult to attain. However, it is easy to get an approximate solution which will probably in most cases be sufficient.

In most cases, whenever we do not make any special assumption concerning the character of the regression of X on Y , we shall probably classify the population π into only a few strata whence it may be assumed that the proportions p_i will not be very small and consequently

p, q, N^{-1} will be considerably smaller than any of the p_i^2 . If so, then the value of the square root

$$(43) \quad \sqrt{p_i^2 + p_i q_i N^{-1}}$$

will be very much the same as that of p_i . For example, if $p_i = .1$, $q_i = .9$ and $N = 100$, it is .1044 and if the value of Np_i were somewhat larger, the agreement would be still better. Therefore, instead of trying to minimize (42) we may usefully start by trying to minimize, say

$$(44) \quad V_1'' = \frac{1}{m_0} \left(\sum_{i=1}^s p_i \sigma_i \right)^2 + \frac{1}{N} \sum_{i=1}^s p_i (X_i - \bar{X})^2, \quad \text{or}$$

$$V_1'' = \frac{a^2}{m_0} + \frac{b^2}{N}$$

for short. Denote by v_1 and v_2 the smallest numbers of selections into the first and the second sample respectively, the total cost of which is the same, so that

$$(45) \quad v_1 B = v_2 A.$$

If m'_0 and N' are the integer numbers minimizing (44) and satisfying (5), then any change of these values by taking instead of them either

$$(46) \quad \begin{array}{lll} m'_0 - v_2 & \text{and} & N' + v_1 \quad \text{or} \\ m'_0 + v_2 & \text{and} & N' - v_1 \end{array}$$

will increase the value of (44). This means that m'_0 and N' satisfy the inequalities

$$(47) \quad \frac{a^2}{m'_0 + v_2} + \frac{b^2}{N' - v_1} > \frac{a^2}{m'_0} + \frac{b^2}{N'} < \frac{a^2}{m'_0 - v_2} + \frac{b^2}{N' + v_1}.$$

These inequalities reduce easily to the following ones

$$(48) \quad \frac{1 - \frac{v_2}{m'_0}}{1 + \frac{v_1}{N'}} < \frac{a^2 v_2}{m_0'^2} \frac{N'^2}{b^2 v_1} < \frac{1 + \frac{v_2}{m'_0}}{1 - \frac{v_1}{N'}}$$

showing that in order to minimize (44) while keeping (5) fixed, we have to select m_0 and N as nearly as possible proportionately to $a\sqrt{v_2}$ and $b\sqrt{v_1}$ respectively. Putting for a moment

$$(49) \quad m_0 = N(a/b)\sqrt{v_2/v_1}$$

and substituting it in (5), we get

$$(50) \quad N = Cb\sqrt{v_1}/(Aa\sqrt{v_2} + Bb\sqrt{v_1})$$

which gives

$$(51) \quad m_0 = Ca\sqrt{v_2}/(Aa\sqrt{v_2} + Bb\sqrt{v_1}) .$$

Using (45) and eliminating v_1 and v_2 we may rewrite (50) and (51) in the final form

$$(52) \quad N = Cb/(a\sqrt{AB} + bB)$$

$$(53) \quad m_0 = Ca/(aA + b\sqrt{AB})$$

where

$$(54) \quad a = \sum_{i=1}^n p_i \sigma_i$$

and

$$(55) \quad b^2 = \sum_{i=1}^n p_i (X_i - \bar{X})^2 .$$

Here we must remember the following circumstances:

(1) that both m_0 and N are integers and therefore formulae (52) and (53) should be calculated to the nearest integer;

(2) that a change in m_0 by one unit must be compensated by a change in N by several units;

(3) that the solutions which would be obtained by taking exact values of (52) and (53) would minimize the value of (44) with a as given in (54), whereas the value of the variance in (42) depends on

$$(56) \quad a_1 = \sum_{i=1}^n \sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}}$$

instead of a .

It follows that the integers nearest to (52) and (53) may not necessarily minimize (42), but since the difference between a and a_1 is slight, they may be considered as the first approximations. Frequently these first approximations will also be the accurate values.

In order to find the second approximation, we may calculate a_1 as in (56) substituting N as calculated from (52) and then substitute the value obtained into (53) to get a new value of m_0 . This sometimes will indicate the necessity of increasing the original m_0 by unity. How-

ever, owing to the fact that both m_0 and N must be integers, the real check of what values do give the minimum is obtained simply by substituting into (42) both the first approximations to m_0 and N and a few neighboring systems of values, e.g., m_0-1 and m_0+1 and the corresponding values of N .

4 EXAMPLE I

It may be useful to illustrate the above theory by some simple examples. Assume that there are only three strata, so that $s=3$. Assume further the following values of the constants involved:

$$\begin{aligned}
 (57) \quad & p_1 = \frac{1}{4}, & p_2 = \frac{2}{4}, & p_3 = \frac{1}{4}, \\
 & X_1 = 1, & X_2 = 3, & X_3 = 6, \\
 & \sigma_1 = 1, & \sigma_2 = 2, & \sigma_3 = 4, \\
 & A = 4, & B = 1, & C = 500.
 \end{aligned}$$

In order to calculate the values of m_0 and N , we calculate

$$(58) \quad a = 2.25,$$

$$(59) \quad \bar{X} = 3.25,$$

$$(60) \quad b^2 = 3.1875 = (1.7854)^2.$$

It follows that

$$(61) \quad N = 142 \quad (\text{to the nearest integer})$$

and accordingly

$$(62) \quad m_0 = 89.$$

It will be seen that the necessity of taking m_0 to the nearest integer permits an increase in the value of N to 144, without exceeding the limit of expense, 500 units. Let us now see how $m_0=89$ should be distributed between the three strata. Easy calculations give

$$\begin{aligned}
 (63) \quad & \sigma_1 \sqrt{p_1^2 + p_1 q_1 N^{-1}} = .2526 \\
 & \sigma_2 \sqrt{p_2^2 + p_2 q_2 N^{-1}} = 1.0035 \\
 & \sigma_3 \sqrt{p_3^2 + p_3 q_3 N^{-1}} = 1.0104 \\
 & \sum_{i=1}^3 \sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}} = 2.2664.
 \end{aligned}$$

Hence, using (41) and taking the nearest integers, we get

$$(64) \quad m_1 = 10, \quad m_2 = 39, \quad m_3 = 40.$$

With this system of the m_i the middle term of formula (40) would have the value

$$(65) \quad \sum_{i=1}^s m_i \left(\frac{\sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}}}{m_i} - \frac{\sum \sigma_i \sqrt{p_i^2 + p_i q_i N^{-1}}}{m_0} \right)^2 \\ = .0000048564 .$$

The total value of V_1 in (40) is found to be

$$(66) \quad V_1 = .079855$$

and it follows that by using (64) the value of the middle term is for all practical purposes negligible. It is interesting to compare this value with the one which could be obtained without adjusting the numbers m_i to the variability and the size of the strata, i.e., without using (41). Putting arbitrarily $m_1=29$, $m_2=m_3=30$, we get

$$(67) \quad V_1 = .091927 .$$

Comparing this with (66) we see that neglecting to adjust the m_i according to formula (40) results, in this particular example, in an increase of the variance by over 15 per cent, which is a considerable and unnecessary loss in accuracy.

This is the situation if we use for m_0 and N the values found as first approximations. Substituting 144 for N in (56) and calculating a_1 and then using this value instead of a to calculate the second approximation of m_0 , we get

$$(68) \quad m_0 = 89.6783$$

which suggests that the best integer values of m_0 and N are $m_0=90$ and $N=140$. However using them we obtain

$$(69) \quad V_1 = .079866 .$$

Again using $m_0=88$ and $N=148$ we get

$$(70) \quad V_1 = .079888$$

and it appears that the first approximation gives in fact the best possible result, but the actual difference is negligible.

We must now see whether this result, the best that could be obtained by the method of double sampling is actually better than what could be obtained by spending all the money available to collect as much data on X as possible, i.e. by drawing the unrestricted random sample S_0 (see p. 103).

The best linear estimate of \bar{X} calculated from the sample S_0 would be the sample mean \bar{x} . Its variance, V_0 , is known to be connected with the symbols of this paper by means of the formula

$$(71) \quad V_0 = \frac{1}{M} \left(\sum_{i=1}^s p_i \sigma_i^2 + \sum_{i=1}^s p_i (X_i - \bar{X})^2 \right).$$

It is easy to find that in our example

$$(72) \quad M = C/A = 125$$

and

$$(73) \quad V_0 = .0755 .$$

It follows that in this particular case the method of double sampling even supplemented by the optimum adjustment of the numbers of sampling, is equivalent to a certain loss of accuracy of the final result. Taking the ratio of the variances (73) and (66)

$$(74) \quad V_1/V_0 = 1.058$$

we see that this loss of accuracy amounts to nearly 6 per cent. This unfavourable result is, of course, due to the fact that the differentiation between the strata with respect to the values of X is small compared with the variability of the strata themselves and to the fact that the difference in the cost of obtaining data on X and Y is comparatively small. To illustrate this point let us consider the following examples.

5 EXAMPLE II

Assume that the values of the p_i , X_i and σ_i are exactly as in Example I and put

$$(75) \quad A = 40, \quad B = 1, \quad C = 5000$$

so that the process of obtaining data on Y is now 40 times cheaper than that on X , while the ratio of C/A is the same as formerly. It follows that V_0 in this case will be exactly the same as formerly (73), but the minimum value of V_1 will change. We shall have

$$(76) \quad m_0 = 111, \quad N = 560$$

and, assuming that the m_i are fixed according to (41), we get finally

$$(77) \quad V_1 = .05147$$

and it is seen that this value is exceeded by V_0 by more than 46 per cent!

6 EXAMPLE III

Here we shall keep the values of the p_i , the σ_i , and those of A , B and C as in Example I but change the values of the X_i so as to increase the value of b , namely put

$$(78) \quad X_1 = 1, \quad X_2 = 6, \quad X_3 = 11.$$

Then

$$(79) \quad b^2 = 12.5 = (3.53553)^2$$

and

$$(80) \quad V_0 = .1500.$$

On the other hand, applying the method of double sampling and taking the optimum system of numbers of samplings, viz.,

$$(81) \quad m_1 = 8, \quad m_2 = 31, \quad m_3 = 31, \quad m_0 = 70, \quad N = 220$$

we get

$$(82) \quad V_1 = .1298,$$

a gain in accuracy in comparison with (80) of about 15 per cent

7. CONCLUSIONS

(i) The examples II and III show that under favorable conditions the method of double sampling is a very powerful tool of statistical research.

(ii) However, the advantages of methods are but rarely universal and in certain cases, as for instance in the above example I, the direct unrestricted sampling may be more efficient than the method of double sampling.

(iii) Without a certain previous knowledge of the properties of the population sampled it is impossible to say which of the two methods will be more efficient.

(iv) It is also impossible to tell in advance what the values of N , m_0 , and of the m_i should be to assure the greatest accuracy of the double sampling method.

(v) On the other hand, if certain properties of the sampled population π are known, or can be estimated, then it is possible to estimate the values of m_0 and N and also those of the m_i by which the method of double sampling gives the greatest possible accuracy. The properties of population π needed for this purpose are the values of the p_i , σ_i , and X_i . They could be estimated by means of a preliminary inquiry on the lines suggested by me during the conference at the U. S. Department

of Agriculture Graduate School and also in my previous publications on sampling human populations.³ Once approximate values of the p ., σ , and X , are obtained, they should be substituted into formulae (52), (53) and (41) to obtain the approximations of the optimum values of m_0 , N and the m ..

(vi) Before deciding whether to apply the method of double sampling, we should see that the prospects are that it will give better results than the direct unrestricted sampling of values of X .

For this purpose the approximate values of the p ., σ , and X , should be substituted into (40) and (71) to obtain the approximate values of variance V_1 and V_0 . The decision to apply the method of double sampling should be taken only if the approximate value of V_1 proves to be considerably smaller than that of V_0 .

(vii) The steps described in (iii) and (iv) are possible only if some previous knowledge of the population π is available. This may be obtained from various sources: from some previous experience concerning the population π , or from a specially arranged preliminary inquiry. Such a preliminary inquiry consists of drawing from π a relatively small unrestricted random sample of individuals and in ascertaining for all of them the values of both characters under consideration X and Y . The data thus obtained should be used to estimate the p ., the σ , and the X ..

In order to exemplify the kind of previous experience which may be used to plan future inquiries on the lines as indicated in (v) and (vi), I may mention a recent extensive Study of Consumer Purchases, a Federal Works Project administered by the Bureau of Labor Statistics, U. S. Department of Labor and the Bureau of Home Economics, U. S. Department of Agriculture, in cooperation with the National Resources Committee and the Central Statistical Board.⁴ This inquiry was carried out by method of double sampling and therefore, in the process of working out the data, both the proportions p , and the means X , corresponding to particular strata and to many a character X must have been estimated. Probably the values of σ , are also available. These figures could be used as pointed out in (v) and (vi) when planning any new inquiry concerning the same characters and the same or some similar population.

³ J. Neyman "An Outline of the Theory and Practice of Representative Method Applied in Social Research" Institute for Social Problems, Warsaw 1933. Polish with an English Summary.

J. Neyman: "On the Two Different Aspects of the Representative Method." J. R. S. S. 1934, pp 558-625

See also P. V. Sukhatme "Contribution to the Theory of the Representative Method." Supplement to the J. R. S. S., Vol. II, 1935, pp 253-268

⁴ This JOURNAL, Vol. XXXI, 1936, p. 135 and Vol. XXXII, 1937, p. 311.

THE PROBLEM OF MEASURING RADIO COVERAGE*

By L. D. H. WELD

Director of Research, McCann-Erickson, Inc.

OF THE many unsolved problems connected with radio research, one of the most important is that of determining by uniform standards the area over which a broadcasting station may claim coverage. It is to this problem that the Joint Committee on Radio Research has been devoting the major part of its energies for several months.

This committee consists of five representatives of the broadcasting industry, five of the Association of National Advertisers, and five of the American Association of Advertising Agencies. It was organized in the fall of 1935, to study problems of radio research. Although the author of this paper is a member of the committee, he is expressing his personal views on the subject under discussion, rather than official findings of the Committee.

The reasons for the need of an early solution of this problem are obvious. Those who have studied the claims of broadcasting stations realize that their coverage maps have been determined by a variety of methods, and that the advertiser is at a loss to know over what territory he can really reach a sizeable audience with any single station or groups of stations. The situation is especially confusing in trying to compare the coverage of competing stations that serve the same areas.

There can never be a real meeting of minds on this subject until questions of definition have been settled. Just what do we mean by station coverage? To begin with, there are two approaches to this problem. The first is from the standpoint of the broadcaster. He necessarily wants to know over what area his station delivers a reasonably audible signal. Such information is fundamental, not only to the individual station, but also to the Federal Communications Commission, whose duty it is to decide on the number of stations, their locations, their power, and their frequencies.

The other approach is from the standpoint of the advertiser, who is interested primarily in knowing over what area a station reaches a substantial audience. He isn't so much concerned with the strength of the signal, as he is with the location of actual listeners.

The first approach naturally leads to a study of the area over which a signal of certain strength is delivered. We might call this the "signal

* A paper presented at a Joint Session of the American Statistical Association and the American Marketing Association, Atlantic City, New Jersey, December 29, 1937.

strength area." It represents the *potential* coverage of a station,—or the area in which people *can* hear the station if they want to.

The second approach naturally leads to a study of the area in which people actually tune in regularly to the station in question. This has been defined by the Joint Committee as the "listening area."

If signal strength areas and listening areas coincided, the problem would be greatly simplified. But studies made by the Joint Committee and by other organizations clearly prove that signal strength areas and listening areas do not necessarily coincide. In some cases they do (for all practical purposes); but in a large number of important instances they are substantially different. Sometimes the signal strength area is the larger, and sometimes the opposite is true.

This means that signal strength areas and listening areas are two different things. It is the object of this paper to prove this point. Not until we realize that there are two different problems will broadcasters and advertisers understand each other's points of view. Of course, many broadcasters do realize that listening areas are different from signal strength areas. The very fact that the two leading broadcasting companies have made elaborate studies to determine listening areas is proof of this point. It is to the interest of broadcasters to give to advertisers accurate information as to where their listeners are located, as well as to let them know where they can effectively deliver a program. Possibly the Federal Communications Commission may also want to take listening areas into consideration in the performance of its functions.

Before showing that signal strength areas and listening areas are two different things and do not coincide in many important instances, it is necessary to describe briefly the methods that have been used in determining these two types of areas.

With regard to signal strength measurements, there are two general types of surveys that have been made. One has been to delineate the area covered by a single station, by sending out a motor car equipped with the necessary apparatus in various directions from the city where the station is located, so as to determine the points where the signal falls below one-half millivolt. A contour map is then drawn, showing the area wherein the signal of over one-half millivolt is delivered. Such measurements have been of ground wave only. Little attention has been paid to noise level or interference. The one-half millivolt limit was arbitrarily set by the Federal Communications Commission, but has recently been discarded by them. Methods of measuring signal strength have not been standardized. This is a problem which the Joint Committee expects to tackle as soon as possible.

The other type of field strength measurements may be called area or locality surveys. The object is to go into one locality or district and measure the signal strength of all stations reaching that locality. One well-known service is based on this type of signal strength measurement, and in this instance account is taken of sky wave, noise level, and interference.

The commonest method of determining listening areas has been through an analysis of audience mail. The Joint Committee has studied the audience-mail method, but has come to the conclusion that the only practical method of determining listenership for all competing stations at the same time is through personal interviews.

In the examples given below showing the differences between signal strength areas and listening areas, the signal strength measurements have been obtained in different ways and have been furnished to the Joint Committee by broadcasting companies. The listening area data are those obtained through personal interviews by the Joint Committee in its experimental work in New England. The final technique for delineating listening areas by personal interviews has not yet been determined, but the maps and data below furnish sufficient proof that whatever refinements in technique are developed there are substantial differences between signal strength areas and listening areas in many cases.

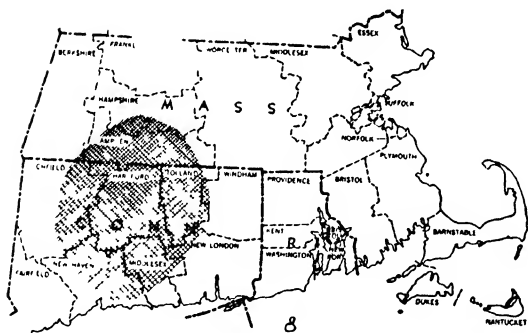
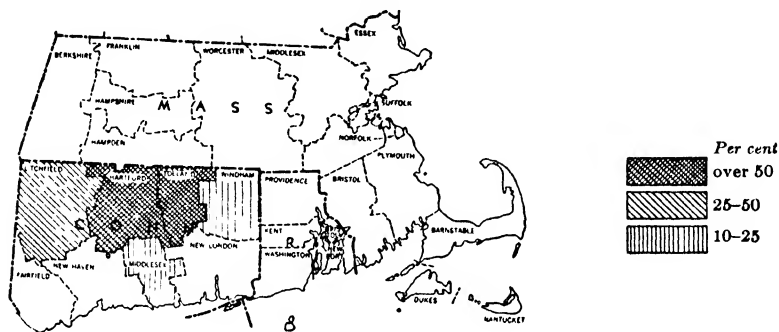
The maps show signal strength areas and listening areas determined by personal interviews,—all for daytime. Refinements in determining signal strength areas in the future may result in more accurate results. The same is true of listening areas. But it is inconceivable that such changes will alter the conclusions reached in this paper.

In the examples given herein there is one case (Station A) where the listening area is more restricted than the signal strength area. There is another case (Station B) where the two areas are practically the same. There are two other cases (Stations C and D) where the listening areas determined by personal interview are quite different and much more extensive than the signal strength areas. (Because of difficulties of reproduction in the JOURNAL, only the maps for Stations A and C are reproduced herein.)

The first two maps show the data for Station A. The map of the one-half millivolt area as determined by field strength measurement appears below and the map of the listening area as determined by personal interviews appears above. In the listening area maps, the heavy cross-hatching represents counties where over 50 per cent of the families listen regularly to the station; the next zone is that in which from 25 to 50 per cent listen; and the light vertical lines show where 10 to 25 per cent use the station.

It will be seen that according to signal strength, there is excellent coverage in Hampden County, Massachusetts, and some coverage in Hampshire County. The personal interview method shows practically no listeners in these two counties. Only Hartford and Tolland Counties have over 50 per cent listenership. Litchfield County has between 25 and 50 per cent and the other two light-shaded counties in Connecticut have under 25 per cent. Note that according to signal strength this

LISTENING AND SIGNAL STRENGTH AREAS FOR STATION "A"

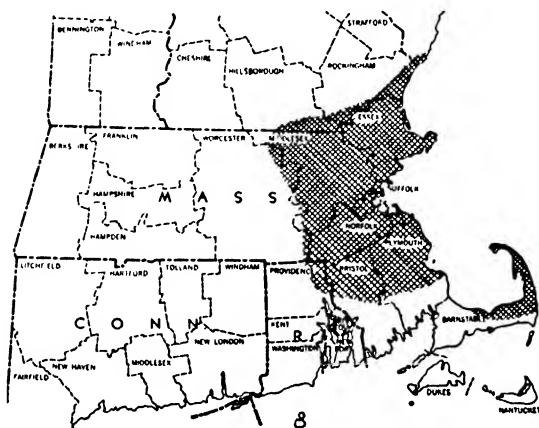
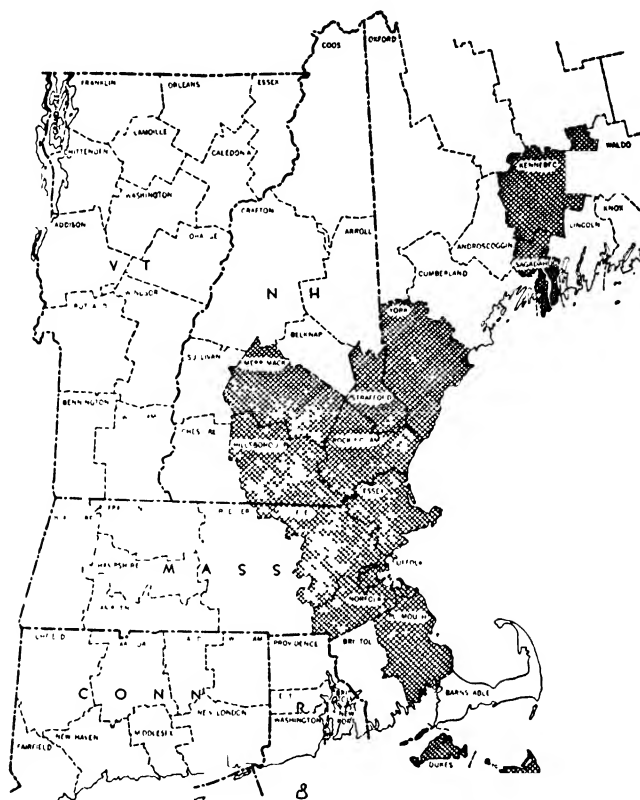


The upper map shows the listening area as determined from personal interviews. The lower map shows the signal strength area.

station reaches most of New Haven County where practically no listeners were found.

The next two maps (not shown here) compare the respective daytime areas for Station B. Suffice it to say that the two territories closely correspond, except that personal interviews found between 25 and 50 per cent of the families in Windham County, Connecticut, listening to this station, whereas the signal strength area does not include this county.

LISTENING AND SIGNAL STRENGTH AREAS FOR STATION "C"



The upper map shows the listening area as determined from personal interviews. The lower map shows the signal strength area.

The next two maps compare the signal strength area of Station C with the listening area determined by personal interviews. In the listening area map, we show only "primary" area,—that is where over 50 per cent of the families say they listen to this station. If we were to include secondary and tertiary counties, all of New Hampshire would be included, as well as many additional counties in Massachusetts and Maine.

It will be seen at a glance that the listening area as determined by personal interviews is much more extensive than the one-half millivolt area. The former includes several counties in Southern New Hampshire and in Maine. Note particularly how Kennebec and Sagadahoc Counties in Maine fall within the area of this station.

The maps for Station D (not reproduced here) show that the listening area extends much farther North and into New Hampshire than does the signal strength map.

We now come to some comparisons between field strength studies made by Edgar Felix of New Rochelle, who has developed an elaborate system of field strength measurement, and percentage of families listening as determined by personal interviews for various stations in New Haven, Connecticut, and Kent County, Rhode Island.

It should be explained that the use of the Felix figures involves no criticism at all of the Felix service. From what we know of this service, it is a very valuable one conducted thoroughly and with a high degree of intelligence. The comparison offered here is simply to strengthen our point that quality of reception of a station in a given area does not tell us the percentage of radio homes in that area which listens to the station.

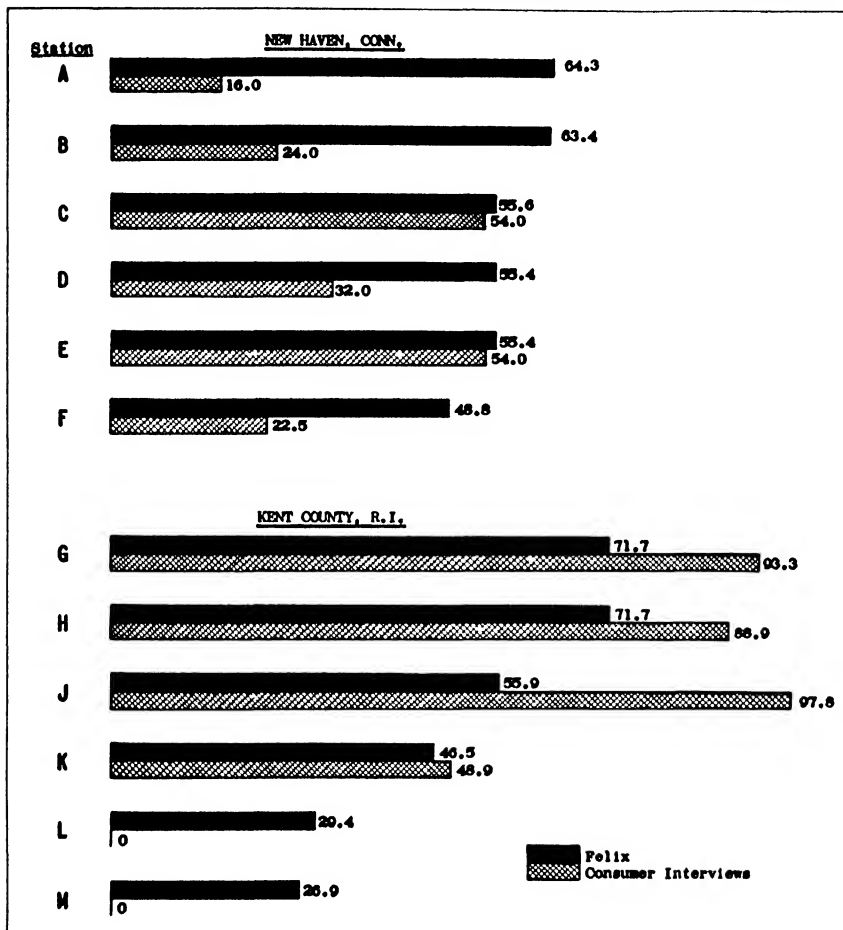
On the accompanying chart, it will be seen that the Felix rating for Station A is 64.3 per cent; personal interviews reveal only 16 per cent of the families listening regularly to this station. There is a similar difference in the case of Station B. It will be noted for Stations C and E that the results are practically the same by both methods. There are large discrepancies for Stations D and F.

In the case of Kent County, Rhode Island, it will be seen that actual listenership is much higher than the Felix rating would indicate for the first three stations. For Station K the results are practically the same. In the cases of Stations L and M, Felix finds a fairly good signal whereas personal interviews reveal nobody listening to these stations.

The cases cited on the foregoing pages are typical. Any number of additional instances could be used. The Technical Committee believes that these data clearly prove that areas determined by field strength surveys do not coincide with actual listening areas in many important

instances. In other words, there are other factors besides quality of signal that determine the areas in which people regularly listen to a broadcasting station.

FIELD STRENGTH RATINGS COMPARED WITH PERSONAL INTERVIEW RATINGS



Some of the reasons why signal strength areas and listening areas do not coincide are as follows: for a given station the signal may be clear, but the listener prefers to hear the same program on another station that delivers an even better signal; or, the signal may be poor, judged from engineering standards, and yet be the best that can be obtained; or, preference for a station in the listener's home state is sometimes a factor; there is also the matter of habit in listening to cer-

tain stations; and finally there is the all-important question of average quality of programs delivered by different stations,—a subject that will be referred to below.

The foregoing discussion explains why advertisers and advertising agencies are primarily interested in listening areas, and why the Joint Committee, through its Technical Committee, has been making intensive studies first in New England, and later in scattered counties throughout the country, in order to find the best technique for determining such areas.

This has been a long and complicated task. The principal problem has been to discover the best way of asking people what stations they generally or regularly use for the reception of programs. We made our first experiments in the Hartford territory, extending them to other sections of Southern New England, and then covered the whole of New England. Since then we have made additional tests in individual counties in New England and finally in five scattered counties, one in Pennsylvania, three in the Mid-West, and one in the South. In all, there have been about 10,000 personal interviews and fifteen different forms of questionnaire have been tried out. Station mail data for fifteen stations have been tabulated and analyzed. The construction of between 200 and 250 maps and charts has been necessary. The tabulation of the data and the preparation of material for the use of the Technical Committee have meant a tremendous amount of detail work.

Space forbids a detailed description of the difficulties encountered, or of the various techniques that have been tested out by the committee. It has already been mentioned that after consideration of various approaches, the Committee decided that the only safe and practical method is through personal interviews, and we have been trying out different wordings of our questionnaire. We have been working on the basis of an average of 100 calls per county, and various tests have indicated that a sample of this size yields reliable results. The county is used as the unit, because it is a small enough geographical district for the laying out of listening areas, and because various economic data, including estimates of number of radio homes (prepared and issued by the Joint Committee) are available on this basis.

The Technical Committee expects to make a few more tests in January or February, 1938, and then hopes to reach a final conclusion on the best technique for determining listening areas. Not that this will be a simple thing to do. In the first place, there will be the question of the degree of accuracy possible or necessary. It is obvious now that complete accuracy cannot be obtained. The extent to which a station is listened to in any one locality depends not only upon the clarity of

its signal, but on the average appeal of all of its programs. There are individual instances where an obscure station may have one outstanding program that is listened to by a substantial number of people. All we can hope to obtain is a general average of listening. Our experiments show that the average amount of listening to different stations in one locality varies substantially, and we believe that sufficiently accurate data can be obtained for all practical purposes.

There is then the problem of dividing the listening area into primary, secondary, and probably tertiary areas. So far we have been considering as the primary zone, the area in which 50 per cent or more of the radio homes regularly use the station. The secondary zone is from 25 to 50 per cent, and the tertiary zone, from 10 to 25 per cent. These limits have not been finally decided on, and the final decision will have to be a fairly arbitrary one. An unfortunate result of any such zoning system is that it may be slightly unfair to border-line stations. If a station is listened to by 49 per cent of the people in a certain county, that station will naturally be disappointed to find the county put into the secondary zone.

So far, the Joint Committee has been considering only the setting up of these zones by counties without showing the percentage of radio homes listening regularly to each station in each county. It would be unfair to give out these actual percentages. On the other hand, through the use of these county percentages, held under lock and key in a central bureau, it would be possible to figure the approximate normal or average circulation of a station in its listening area. This would mean that advertisers would have figures for radio analogous to the circulation figures they have for magazines and newspapers. It has not been decided whether such circulation figures should be compiled, but it is obvious that they would be of substantial value to advertisers.

When the Joint Committee has finally decided on the best technique for determining listening areas, there will still be the problem of putting this technique into effect throughout the country. It will be a big and expensive job. If the method determined is accepted as the "official" method of delineating listening areas, it seems as though ways and means ought to be found for financing this important project.

QUANTITATIVE METHODS IN POLITICS*

BY STUART A. RICE

Chairman, United States Central Statistical Board

THE TITLE of this paper was the title of a book published in 1928, and I am speaking as its author. In that book I sought to replace a number of general descriptive statements concerning American politics and political occurrences with precise numerical statements. Simple statistical methods were applied to the analysis of commonplace data, especially to data that related to political attitudes and public opinion.

The accurate measurement of public opinion is a central problem for a science of politics. In authoritarian states such measurement would be difficult, whether officially or unofficially sponsored. In democratic states, on the other hand, the idea and the habit of measuring opinion are firmly established. Representative government assumes that the will (or opinion) of the people should be ascertained and given effect through elections. General and primary elections, referenda and straw votes are a part of the same culture complex, and all are statistical measurements of public opinion. I believe that Mr. Gallup's important statistical data have interested newspaper readers because the American public is habituated to elections and polls.

The economic importance of opinions and attitudes is generally recognized. To illustrate, the National City Bank asserts in its December, 1937, review of economic conditions:

The business of the country is an aggregate of the actions and policies of millions of individuals and corporations, all following the best judgments they can bring to bear on their own problems; and it might be supposed that their difference of opinion would cancel out. But that is not always the case. They are all subject to the same economic and psychological influences. By and large they tend to go forward together, planning and spending confidently; and conversely, they curtail and economize together. The changes from one policy to the other mean a vast difference in the volume of trade and the level of prices.

While such statements as this stress the importance of opinion as an economic factor, there has been comparatively little effort to evaluate this factor quantitatively, except, perhaps, in the case of market analyses. Yet I believe that many aspects of the opinion factor in business are measurable. In the citation from the National City Bank just quoted there is suggested a counterpart in business to what I have termed the "landslide tendency" in politics. Landslides of opinion, both as to politics and as to prudent economic behavior, probably

* A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 28, 1937.

result from the rapid growth of mass communication through newspapers, motion pictures, and the radio. As agencies of mass communication extend their influence, the landslides become greater. Here is an hypothesis of seeming importance, susceptible, I think, of quantitative testing. Unfortunately for the purpose, the votes of stockholders at meetings of corporations are less adequate indexes of opinion than their analogues, the popular votes in political elections.

It need not be argued further that opinions and attitudes have important consequences, justifying attempts to express them in numerical terms. We turn then to methods of measurement. The traditional or rule-of-thumb method is an election.

Elections presuppose the complete summation of opinion upon current political issues within a universe (the electorate); just as straw votes assume representative sampling. Actually, in democratic countries, elections never obtain complete "coverage" of the electorate. The non-voter is a perennial problem of American politics. Nor do elections provide opportunity for the full expression of opinion by the voter upon even a single subject. There is seldom a chance for him to say more than "yes" or "no" upon what may be a complex question. Most frequently his opinion is not expressed upon a question at all, but upon a list of candidates whose individual opinions he is unlikely to know. If he did know them, he would probably find that the opinions of any candidate on some questions coincided with, and on other questions differed from his own.

As a statistical method, an election may be described as a voluntary self-recording of opinion by some members of the electorate upon a greatly simplified statistical schedule. Totals depend upon voluntary appearances by voters at polling places on a single date. There are no follow-ups, no recanvasses, a minimum of instructions and explanations, and no checks upon the understanding by the respondent of the questions asked. The tabulating process is a simple hand-count, without cross tabulation with other known data in ways customary in statistical machine tabulation.

The statistical method of election may be contrasted with the method of census. Censuses have usually been employed for the collection of objective data, but their use to collect subjective information is by no means rare, and they offer an alternative to the method of election as a means of summing opinions and attitudes. By the census method an approximately complete coverage of the universe is obtainable. Each individual, without initiative on his part, is approached by an enumerator and invited, or required under penalties for non-compliance, to answer the questions asked. These may be

elaborated where the issues in an election must be oversimplified. Trained enumerators may elicit more accurate formulations of opinion from some individuals than these would be able to construct for themselves independently.

An election will not provide an accurate summation of public opinion unless, by chance, the opinions of those who vote and the issues upon which they vote are representative samples of the opinions of all persons having opinions upon all pending issues. For example, it has been contended that the President holds the support of the electorate but that the latter is out of sympathy with certain New Deal policies for which he stands. This contention, if true, illustrates the unadaptability of the election method to the measurement of public opinion. It does not discredit the representative form of government or the use of elections to select public officials. Moreover, the method of election is in accord with our national traditions of individualism. The method of census is less "democratic" for it does not have the voluntary aspect of an election.

It is currently proposed that a national referendum election should precede our entrance into foreign war. According to this plan, if a majority of voters acquiesced all of the people might then be called upon to risk their lives and property, but not otherwise. It is assumed that the voters have competence, without special knowledge or educational preparation, to pass upon this question; also that the lives and property of non-voters and of an opposing minority may justly be put in jeopardy by the votes of the majority. Waiving these debatable assumptions, let us assume that in a matter of such consequence an accurate summation of opinion is essential.

For this purpose, the method of census is superior to the method of election. The census could reach some millions of people who would be directly affected by war but who would be ineligible to vote in an election. There could be specially trained enumerators, with a carefully prepared schedule or ballot, covering alternative statements of proposed public policy. These statements could be arranged upon a scale from the most belligerent to the most pacifistic. Items of information concerning the respondent himself could be obtained, such as sex, age, marital status, and whether or not a legal voter. Opinions could then be correlated with these items. For example, it could be ascertained whether the young men of 18 to 31 were more or less in favor of war than their elders, their wives and sweethearts, or other groups within the electorate.

All answers would be compulsory but confidential. Enumerators would be instructed to avoid suggestions that would influence the

replies, though they might make factual statements, officially authorized, which would serve as premises for the questions asked. Thus, the enumerators might state that a hostile air fleet was on its way toward our shores across the Atlantic. The official statement on following days could be revised in accordance with any change in the factual premises. The possibility of daily changes in the official statement introduces an uncontrolled and unfortunate variable into the census procedure. However, the absence of such an official statement would introduce an even greater possibility of bias, because of the variety of propaganda and other influences to which the respondents would be subjected.

A census of opinion on a proposed declaration of war would require considerable time, during which the prospective enemy might obtain military advantages; but this factor of time is also involved in the election method, to which alone I am offering the census method as an alternative.

The recent National Unemployment Census, despite its name, is a good illustration of the election method of measuring opinion, and of the contrast between that method and the method of census. It was believed by many students, including the present speaker, that only a true census—a door-to-door canvass by trained enumerators—would provide a relatively accurate account of unemployment in the United States. In part this belief was based upon the seeming impossibility of obtaining either a complete coverage of the unemployed, or a representative sample within the universe, by any other method. The belief was also based upon the need for information regarding the employment status of the entire gainfully occupied population, in order to interpret data pertaining to the unemployed part of the population.

The method of census, however, was rejected in favor of the method of self-registration, or election. In effect, the National Unemployment Census was a poll, in which all who wished to do so were given an opportunity to vote upon the question whether they were unemployed or partly unemployed. Their votes were recorded in answer to Questions 2(a) and 2(b) which were key questions on the schedule. Other, more objective inquiries, of which 2(c)—relating to emergency workers—is an illustration, were also on the schedule. To “get out the vote,” many of the devices familiar in a political campaign were utilized. It is interesting to note, however, that the unemployment election approached as nearly as possible to the method of census, without actually employing that method. Ballots (Unemployment Report Cards) were distributed to every home in the country. The voting did not necessitate, as some had proposed, that the voters (the unemployed)

should apply at an election booth or similar place of registration.

Perhaps the chief scientific value of the National Unemployment Census will be the experience provided with the election method of obtaining data hitherto regarded as obtainable only through the method of census.

Straw votes may be obtained by either the method of election or the method of census, or by a combination of the two. The *Literary Digest* polls appear to have been of the election type, since, like the Unemployment Census, they rested heavily upon voluntary returns from mailed questionnaires. The *Digest* poll of 1936 appears to have illustrated the possibility of bias contained in the election method. Mr. Gallup, on the other hand, employs the method of a representative sample census. To the extent that he is able to master the problems of sampling which he encounters, his statistical findings may summarize American attitudes and opinions more accurately than do elections or any other method yet devised.

GOVERNMENT AND THE SAMPLING REFERENDUM*

BY GEORGE GALLUP

The American Institute of Public Opinion

DURING THE PAST few years an idea has been developing in the field of journalism which has caught the imagination of students of social and governmental processes. It is the idea that public opinion—the opinion of the masses—can be ascertained at any time on a wide variety of social and political issues by means of the sampling referendum.

Public opinion is a societal force that spells power. What people think puts governments in and out of office, starts and stops wars, sets the tone of fashion and morality, makes and breaks heroes. It is understandable, therefore, why scholars are following new research leads in the opinion field with such avid interest.

It was not so long ago that the idea of the sampling referendum was generally unknown. James Bryce, the great Englishman whose mellow and penetrating insight gave us the classic volume, *The American Commonwealth*, was totally unaware of it when he wrote in 1888. "The obvious weakness of government by opinion," said Bryce, "is the difficulty of ascertaining it." The organs of opinion in America, he observed, are almost as numerous as the people themselves, "and they are all engaged in representing their own view as that of 'the people'." The only positive test to separate genuine public opinion from that which is counterfeit, Bryce pointed out, is to hold elections and submit specific questions to the popular vote. But this is not feasible, he declared, because of the expense. Inability to poll the electorate on questions of public policy, Bryce concluded, "is the first drawback to the rule of public opinion."

But even as Bryce wrote, the germ of an idea had been grasped by a few American newspapermen. As early as 1883, for example, General Charles H. Taylor, editor of the *Boston Globe*, was using the principle of sampling to speed up his reporting of election returns. He sent his reporters to representative precincts to gather early returns, and used the combined results as a sample of what the final count was likely to be.

In the early 1900's the newspapers began applying this idea of sampling to pre-election canvasses. The *New York Herald*, for example, polled 30,000 registered voters in New York City in 1904. The *Columbus Dispatch* and *Cincinnati Enquirer* commenced polling in 1906 and 1908, respectively, and since that time, with one or two exceptions, have conducted polls in every biennial election.

* A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 28, 1937.

While the newspapers were the first to make practical use of the sampling referendum in reporting public opinion, it remained for the *Literary Digest* to bring the technique to the attention of the whole country. In 1916 this magazine discovered the possibilities of sampling referenda as vehicles for circulation drives. Beginning in 1920 the *Digest* periodically conducted nationwide canvasses on such questions as prohibition and the soldiers' bonus, and on presidential candidates. In these polls ballots were distributed to millions of people all over the nation, and the returns were liberally reported in the newspapers and over the radio. The *Literary Digest* made America conscious of the validity of the sampling referendum as a measure of public opinion.

As a general rule, political leaders gave little recognition to newspaper polls until 1932 when Mr. Emil Hurja joined the headquarters staff of the Democratic National Committee. An able political analyst, Mr. Hurja made careful studies of voting sentiment during the campaign, deriving much of his material from sampling referenda. I venture to predict that political strategists will pay increasing attention to systematic studies of public opinion and that, in the future, no party headquarters will consider itself completely staffed unless it is able to command the services of men who are expert in the technique of opinion sampling.

Until 1934, curiously enough, professional statisticians had little or no hand in the planning and direction of newspaper polls. The job was usually assigned to a hardpressed reporter who knew little about sampling; and, with some exceptions like the *Columbus Dispatch*, the *Cincinnati Enquirer*, and the *Chicago Journal*, the emphasis was placed largely on the promotional aspects of the poll. This latter flaw, as I shall point out later, was primarily responsible for the downfall of the *Literary Digest*.

During the period 1933-36, three trained research men, each from the field of advertising and business research, set out to design sampling referenda along statistically sound lines. The Fortune Quarterly Survey was developed by Paul Cherington and Elmo Roper, Jr. in 1935, and since that time the results of the Survey have appeared quarterly in *Fortune Magazine*.

Archibald Crossley developed his poll for the King Features Syndicate during the 1936 presidential campaign. Primarily an election poll, the canvass was not continued after the November balloting.

The American Institute of Public Opinion began experimenting with the problem of nationwide polling in November 1933. In October 1935, it started its series of weekly polls and, since that date, has been rendering an opinion news service to about sixty daily newspapers over the country with a circulation of several million readers.

It is evident that opinion polls have become an integral part of the American scene. The history of these surveys has been characterized by continued refinement of the sampling technique, by wider application from primarily election polls on candidates, to referenda on all manner of social and political issues, and by increasing public acceptance of the validity of their returns. Developed in the newspaper world, these sampling referenda have become an accepted technique of reporting. They are, in the language of journalism, a sort of fourth dimension for the Fourth Estate. Newspapers are today reporting not alone what men do, but increasingly, what men think.

What is the significance of this development? What will be the consequences for representative government?

The first observation to be made about sampling referenda is that they tend to make the mass articulate on issues of the day. The American Institute of Public Opinion calls its service "America Speaks." As we look at it, the Institute is a mechanism through which the mass or any group within the mass can vote their opinions on important political and social issues.

In making the mass articulate, the sampling referendum helps to define the mandate the group gives to its leaders. Bryce observed that while an election of governmental officers is a sort of indirect referendum, it is not a completely satisfactory way of delivering the public's judgment, because elections come only at fixed intervals; and, moreover, it is difficult to separate issues and men.

To take a concrete example: President Roosevelt was elected in 1936 by the largest popular plurality in the history of the country, carrying every state in the electoral college with the exception of Maine and Vermont. What did this vote mean? The President saw in it an unmistakable mandate for the full enactment of the New Deal. The principal obstacle was the Supreme Court. But in Mr. Roosevelt's judgment the 1936 vote for the New Deal was so overwhelming, that it constituted a mandate to circumvent the Court. Accordingly, on February 5, 1937, the President asked Congress to pass a law providing for the retirement of judges over 70 years of age, and the appointment of an additional judge, presumably pro-New Deal, for each old man who refused to step down. Was Mr. Roosevelt right in interpreting the 1936 victory as an authorization to change the Supreme Court?

The people themselves apparently had given no such mandate. Fortunately for historical purposes, the Institute has a complete series of sampling referenda on the question of Supreme Court change. These polls tell a very important story.

In September 1935, seventeen months before President Roosevelt

sent his message on the Supreme Court to Congress, the Institute asked a representative cross section of the American people this question: "As a general principle, would you favor limiting the power of the Supreme Court to declare Acts of Congress unconstitutional?" Sixty-three persons out of every 100 with views on the issue said "No," do not limit the power of the Court.

Fourteen months later, in November 1936, the question was put again: "Are you in favor of limiting the power of the Supreme Court to declare Acts of Congress unconstitutional?" Fifty-nine per cent of the voters now replied: "No," do not limit the power of the Court. But having said this, the voters then indicated their feeling that the Court should move a bit to the left, for when the question was put, "Should the Supreme Court be more liberal in reviewing New Deal measures?" 59 per cent of the people said "yes." It appears, therefore, that before President Roosevelt introduced his plan to change the Supreme Court the public wanted the "Nine Old Men" to be more liberal but they were against a major surgical operation on that body, such as limiting the power of the Court to declare Acts of Congress unconstitutional.

On the day President Roosevelt sent his Court message to Capitol Hill, the Institute set its nationwide sampling machinery into operation, polling the voters on the question: "Should Congress pass the President's Supreme Court plan?" First complete returns showed 53 per cent of the people voting in the negative. Thus, despite the tremendous personal popularity of the President, he started his court fight with a majority of the voters against him.

Every week throughout the dramatic battle over the Supreme Court, the Institute asked the voters the same question: "Should Congress pass the President's Supreme Court plan?" For a time, the Administration appeared to be slowly winning voters to its point of view. In March, when the fight was one month old, the count was 48 per cent in favor of the plan and 52 per cent opposed, a gain of one voter per 100 for the Administration. In early April the vote was 49 per cent in favor of the plan and 51 per cent opposed, another gain of one vote per 100 for the President. But there the anti-Court tide reached its crest.

Following the President's message on the Court, the Justices read a series of 5 to 4 decisions favoring the Administration. They upheld the abrogation of payments in gold; they reversed their decision on the Washington minimum wage law for women, and also declared the Railway Labor Act and the Mortgage Moratorium Act constitutional. Now the Wagner Labor Act was before the high tribunal for judgment. Everywhere the decision was awaited as the crucial test of the Court's

newfound liberalism. On April 12 the decision came. The Wagner Act, one of the most revolutionary laws ever passed by Congress, was declared constitutional. The Court had passed its test on the issue of of liberality. Evidently the "Nine Old Men" were not irreconcilably anti-New Deal.

From that point on, sentiment for Court change began to decline. Two weeks after the Wagner decision the Institute's count stood 47 per cent in favor of change to 53 per cent opposed, a decline of 2 per cent in the President's anti-Court following. Shortly thereafter, Justice Van Devanter resigned and opened the way for a Roosevelt appointee, whereupon the Institute's index of sentiment for Court change dropped 5 per cent, down to 42 per cent in favor and 58 per cent opposed.

In mid-June the Senate Judiciary Committee submitted an adverse report on the bill, and, after attempts at compromise by Senator Robinson and an extremely bitter debate in the Senate, the measure was finally rejected. All through the court fight President Roosevelt held stubbornly to his course, and the indications were that even now he was unwilling to concede defeat.

But the Court issue was dead. Witness the referendum conducted by the Institute early in September: "Would you like to have President Roosevelt continue his fight to enlarge the Supreme Court?" "No," 68 per cent. Only 32 per cent "yes." And witness the special referenda made among the constituents of Senators Burke of Nebraska, Wheeler of Montana, and O'Mahoney of Wyoming, three Democrats who led the fight against the bill. "Do you think the Senator was right in opposing President Roosevelt's plan to enlarge the Supreme Court?" the Institute asked of the voters in these three states. "Yes," 3 to 2, was the reply.

Since its founding in 1935, the American Institute of Public Opinion has continuously reported on the popularity of President Roosevelt and his program. While his standing with the people has varied from time to time, the President, the Institute has shown, has always maintained a majority, and for the most part an overwhelming majority. Yet despite his tremendous personal popularity with the people, they have not been willing to follow him blindly in every New Deal measure he has proposed. They were for the CCC, for social security, for wages and hours legislation; but they voted against the NRA and the AAA shortly before these laws were declared unconstitutional and, as I have described at some length, they steadfastly refused to go along on Supreme Court change. It is only by means of sampling referenda that programs can be separated from personalities and the mandates of the leaders defined.

The sampling referendum performs another function: it gauges the true strength of pressure groups that swarm in and out of Congressional halls.

Late in 1934, you will recall, there came out of the West a plan to end the depression. It was called the Townsend Old Age Pension plan and it proposed to give every person over 60 a pension of \$200 a month provided he would retire from active labor and agree to spend all the \$200 within a month after it was received. Congress rejected the plan by an overwhelming vote in the spring of 1935. But the Townsendites were not to be silenced that easily. They began organizing for political action. They formed Townsend Clubs all over the country, in every state and in most Congressional districts. They collected large sums of money for their war chest. It was their resolve to become the biggest and most powerful bloc of voters wedded to a single legislative project since the days of the Anti-Saloon League.

Dr. Townsend and his cohorts became increasingly vocal, and at his threats to crack the whip, Congressmen grew nervous and alarmed. Some Congressmen who had first opposed the Plan did a political somersault and wrote their pledges of support. Others made special trips to Washington during the off season to offer their cooperation. Would this fantastic movement sweep the country and force the hand of the national legislature?

The Institute, being an opinion news reporting service, set its nationwide staff of interviewers to work testing Townsend sentiment throughout the country. Of thousands of people in every walk of life it asked: "Are you in favor of government old age pensions for needy persons?" and "How much do you think should be paid monthly to each person?" The voters replied, 9 to 1, that they were in favor of old age pensions; but even in the hotbeds of Townsendism, such as Oregon, California, and Washington, the percentage of \$200-a-month Townsendites was small. On the Pacific Coast only 16 per cent voted for this sum, and in the country as a whole only 3.8 per cent named the \$200 figure.

It is interesting to me that the people of this country were sober enough to reject the Townsend plan by such an overwhelming majority, and also that this revelation of Dr. Townsend's strength was followed by a Congressional investigation and eventual collapse of the movement.

While we are discussing what happens when the mass is made articulate by means of sampling referenda, let me call your attention to one other poll which seems to me to be significant. For many years in this country the words "syphilis" and "gonorrhea" have been taboo.

Venereal disease has been regarded as a badge of shame, and victims of these ailments have either concealed their infection or gone to the other end of town to be doctored by third-rate practitioners. With possibly 10 per cent of the American people afflicted, venereal disease was in fact a great national menace. The efforts of public health authorities to combat this scourge were being blocked by a social taboo. Though they ran many stories about tuberculosis, most editors refused to print discussions of the cause and cure of syphilis and gonorrhea; and radio chains ruled the subject off the air. "Fear of offending the public through discussions of venereal disease," said Dr. Thomas Parran, U. S. Surgeon General, "is first and foremost among American handicaps in progress against syphilis."

In December 1936, the Institute, with some trepidation, took the issue of the venereal disease taboo to the public. "Would you be in favor of a government bureau that would distribute information concerning venereal disease?" it asked the voters. Also, "Should this bureau set up clinics for the treatment of venereal disease?" The answer? Ninety out of every 100 in favor of an anti-venereal disease public health campaign. This overwhelming vote plainly indicated that the public was in hearty sympathy with the movement led by Surgeon General Parran, and it is gratifying to observe that during the past year discussions of the social disease have been broadcast from our principal radio stations and carried in the columns of scores of newspapers. Who knows but that a sampling referendum several years ago might have shown the people eager for a public health campaign against venereal disease, and thus dissipated earlier the taboos that have held the movement back these years?

We have said that sampling referenda make the mass articulate, define the mandates of our leaders, reveal the true popular strength of pressure groups, and show social taboos quantitatively for what they are worth. Are there any dangers associated with this new mechanism? Public opinion is powerful; therefore measures of public opinion, widely accepted, carry power. What guarantee has the public of the honesty and impartiality of the organization running the sampling machinery? What guarantee have we that the returns from the sample are accurate and dependable? Does a political poll set in motion bandwagon tendencies that cause people to flock to the winner for the sake of being with the winner and without regard to the merits of candidates or issues? Are politically minded legislators who are trying at one and the same time to sit on the fence and keep both ears to the ground likely to be induced to follow the mob rather than do their duty and vote for the unpopular side if that is for the best interests of the country?

Let me say at once that I consider polls on issues of greater significance than polls on candidates. The latter undertaking provides a legitimate news story which has wide reader interest, and also serves the scientific purpose of testing the sample against official election returns. But the referenda on issues are by all odds the more important. Let us take up in turn the several arguments made against such polls.

What guarantees have we that polling organizations are honest and impartial? In my humble judgment we have a pretty realistic guarantee. The American Institute of Public Opinion is an opinion news reporting agency which derives all its income from the sixty-odd leading newspapers of the country which subscribe to its service. Editorially, these papers are of all shades of opinion. Some are left of center; some are right of center; and some are driving down the middle of the road. Now with a collaboration of this kind, how long do you suppose we would last if we were anything but honest? Furthermore, should any organization or party doubt the honesty and impartiality of opinion news furnished by the Institute, it can check on public opinion with samples of its own. To be dishonest in this business is to commit professional suicide, and I cannot imagine a situation where business necessities are more naturally conducive to plain, unvarnished honesty and faithfulness in the discharge of duty. Review the history of polls for the past thirty years as you will, and I do not believe you will find many cases of deliberate polling dishonesty, for the very reason that I have stated.

But you may say, granted honesty, what guarantee have we that your report is statistically reliable? And if it is unreliable, may it not become a tool of propaganda with the tremendous potency of mass suggestion? As you know only too well, there are no guarantees of dependability of a sample except statistical honesty and skill. If your sample is drawn in correct proportion from all classes in the opinion universe, and if it includes enough cases to bring chance variations within your limits of interpretation, and if the opinion you are sampling has not changed materially since you made your test, then your report is reliable.

Every poll involves some error, great or small, as a result of these factors. In the case of the *Literary Digest*, the shortcomings of method were revealed with great drama and fanfare. Here a poll widely hailed as "uncannily accurate," suddenly ran completely off the track, predicting a Landon landslide in the face of a Landon defeat more crushing than that ever suffered by an aspirant for the high office of President. Why? There is no mystery about it: faulty methods. Students of polls knew that, under circumstances such as those existing in 1936, the *Digest's* face would, after the election, turn to a brilliant red.

With the exception of a few cities, the *Digest* sampled only owners of automobiles and telephones. It neglected for the most part the very poor and those with little purchasing power. Before 1936, political sentiment in the upper income groups was sufficiently representative of the whole voting population to enable the *Digest* to get by. But in 1936 the lines of political cleavage were severely drawn between the haves and the have-nots, and the income bias in the *Digest* sample resulted in a disproportionate number of Landon votes.

We ourselves underestimated Roosevelt's strength by an average of about 6 per cent per state. The reasons, we think, were two: first, sentiment was rapidly moving toward Roosevelt in the closing days of the campaign. Most of the ballots that entered into our final report were gathered before October 15. When we extend our state curves two weeks we find that, in a remarkably large number of states, the curves derived from the samples come close to the official division of the vote in the election.

Secondly, we under-represented the lower income groups in our sample. We studied the turnout of wealthy and poor wards in previous elections with great care, and set our quotas on this basis. But in 1936 the poor were aroused. They went to the polls in much greater numbers than in previous elections, and they were voting for Roosevelt. Our research had misled us in this respect.

Since 1936 we have made further tests of our methodology and have been gratified by the small margins of difference between our samples and official election returns. In the recent mayoralty campaigns, for example, we were only 4 per cent away from LaGuardia's official percentage in New York; and in Detroit, where the CIO was attempting to gain control of the city government, our margin of difference was only 2 per cent.

It should be borne in mind that an election is itself a sample, and conceivably, an unofficial poll can be more nearly representative of public opinion than an official election, due to the variability of turnout among different classes of voters.

In addition to official election figures, there are other indications that our samples are reflecting public opinion with a high degree of accuracy. I have already cited the results of our polls before the collapse of the Townsend Movement and the defeat of Roosevelt's Supreme Court plan. In 1936 the Institute showed Landon as the man most popular with his party's rank and file long before the Republican convention. During the sit-down hysteria early in 1937 our samples showed a declining public patience with the sit-down strike and revealed that the farmers were particularly opposed to this newest weapon of organized labor. It was at Hershey, Pennsylvania, you will

recall, that irate farmers descended on sit-down chocolate strikers and drove them from the plant.¹

Sampling referenda, as I have pointed out, are subject to some error. We are laboring daily to improve our techniques, and, while there is much work to be done, experience shows that our sampling machinery is already performing in a highly satisfactory manner.

Now, what about the bandwagon influence of these polls? Do these referenda accelerate opinion movements in the mass and tend to substitute mob hysteria for reason? Our experience is too short and our techniques for determining cause and effect are too inadequate to render a positive decision, but in the past few years there have been some striking examples in which little or no shift of voters has followed publication of returns from samples or where the shift has been in the opposite direction, to that required by the bandwagon theory.

In the 1932 presidential campaign in Ohio, for example, the poll of the *Columbus Dispatch* indicated that Roosevelt would receive 65 per cent of the total vote to be cast in the state. If sampling polls influence public sentiment, the *Dispatch* returns should have been effective, for the paper has conducted a biennial poll in Ohio for the past thirty years, and is widely known throughout the state for the accuracy of its canvasses. Just before the election a second poll was taken which showed that Roosevelt's strength had dropped to 51 per cent of the total, the approximate figure he received in the official count. In Ohio in 1932, therefore, the evidence indicates that voters dropped off the bandwagon, rather than climbed on.

Again, in April 1936 the American Institute of Public Opinion reported 56 per cent of the Republican vote for Landon as the party's nominee for President. In the final report on May 31, just before the nominating convention, Landon's percentage had dropped microscopically to 55.4 per cent. The knowledge that Landon was the choice of the rank and file of the Republican party was widely spread, yet the measurement made by the Institute showed no bandwagon movement toward the Kansas governor.

In the 1936 presidential election, the surveys of the Institute gave Roosevelt an early lead and indicated that the President's strength increased in the closing weeks of the campaign. In this instance sentiment moved in the direction of the winner. But these data give little support to the bandwagon theory, because the *Literary Digest*, which enjoyed a wide following throughout the country, was forecasting a victory for Landon.

¹ The recent unemployment census furnishes another interesting comparison. The Institute found that 28 per cent of the persons who declared they were unemployed had failed to register in the voluntary census of November 16-20. The check-up sample taken by the government reported that 28 per cent of the unemployed had failed to register.

As a final example, the Institute's recent mayoralty poll in Detroit showed no shift in sentiment from beginning to end. The returns were printed daily in the *News*, the leading Detroit newspaper, yet no evidence of a bandwagon movement developed.

These examples do not prove conclusively that voters are unswayed by sampling referenda, because it can always be argued that the Hoover trend in Ohio, for instance, would have been more pronounced had it not been for the *Columbus* poll, or that Landon's preconvention strength would have trended downward had it not been for bandwagon recruits; but the instances cited certainly make a convincing case against the bandwagon theory. Perhaps voters are not herded so easily as some observers are led to believe. Possibly, even, sampling referenda stimulate minority voters to re-examine the rational basis of their position and reassert their principles with greater conviction. Future experience may give us a clearer answer to this problem.

What about the bandwagon influence among legislators? If polls on issues are continually taken, won't our representatives become puppets in the hands of pressure groups, and the true function of representation be lost? It is certainly true that sampling referenda give the people more power in government. Heretofore issues could be taken to the voters only by means of elections which are both slow and costly. Now, by use of sampling techniques, public opinion can be quickly and inexpensively sounded and the results communicated to the elected representatives of the people.

Under this system of frequent referenda, the function of representation is not lost, for it is well understood that the people have not the time or the inclination or the competence to pass on the myriad of governmental problems that confront their elected officials. Moreover, the democratic process requires leaders to initiate the means by which the values of the group are realized.

Before the days of sampling referenda, legislators were not isolated from their constituencies. They read the local newspapers; they toured their bailiwicks and talked with the man in the street; they received letters from back home; they entertained delegations claiming to be spokesmen for the majority or for large and important blocs of voters. The only change that is brought about by sampling referenda is that a technique is provided whereby the legislator will get a truer measure of public opinion than he has had in the past.

Advocates of a cause don't throw up the sponge when they find they are in a minority. On the contrary, if their conviction is strong, they labor, propagandize, recruit and educate, hoping that their views will become those of the majority. The Socialist party has for years polled only a fraction of the total vote, yet it has carried on election after

election. The periodic revelation of the numerical insignificance of the party has not prevented it from preaching doctrines which it later had the satisfaction of seeing enacted into law by one or the other of the major political parties.

We live in a democracy where the majority rules, where leaders are constantly being chosen by the people, and where the main lines of governmental and social policy are continuously being referred back to the people for their approval. This nation has become great under this democratic procedure, and so far, in a world threatened by dictatorships and totalitarian states, it has managed to preserve a very precious value called "individual liberty." I have faith in democracy, and my experience with the American Institute of Public Opinion only increases my respect for the confidence in the wisdom of the democratic process. When I look at Russia and Germany and Italy and Japan, and see their lines of national policy resolved by a few minds in the direction of war and conquest and regimentation of the individual, spiritually and materially, for the service of the state, I am more sure than ever that Theodore Roosevelt was right when he said:

"The majority of the plain people of the United States will, day in and day out, make fewer mistakes in governing themselves than any smaller group of men will make in trying to govern them."

STATISTICAL BIAS IN PRIMARY DATA AND PUBLIC POLICY*

By A. F. HINRICHS, *Chief Economist*
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THE DEVELOPMENT of public policy with reference to economic problems has subjected the statistical agencies of the Government to an almost unprecedented pressure. Inadequacies of the data have resulted in the demand for an expansion of basic information. For example, the Bureau of Labor Statistics enlarged its sample of manufacturing establishments reporting man-hours worked in one pay-roll period of each month from 10,039 firms employing 1,710,270 workers in January 1932 to 22,205 firms employing 4,565,266 workers at the present time. In terms of estimated total manufacturing employment, we received man-hour reports for 29.5 per cent of the wage earners in January 1932 and for 54.3 per cent in October 1937.

New types of analysis have been required to make basic data throw light on new problems that have become of public interest. Again, to illustrate from the field of employment statistics, it has been necessary to study the monthly reports of groups of establishments within the various industries as well as to compute averages for all establishments in the industry. Two such analyses have been published in the *Monthly Labor Review*—one dealing with changes in hours from 1935 to 1936 and another with changes in average hourly earnings.¹

Finally, there has been an insistent and legitimate pressure to develop subdivisions of the data to focus available information on the problems of particular industries or localities. A government statistical agency has a primary obligation to its contributors to protect the confidential character of their returns, to Congress to live within its means, and to the users of its statistics to guard them against misuse of the data. But these three limitations still leave an agency such as the Bureau of Labor Statistics with some latitude for mining its data to effect their maximum usefulness.

When data collected and edited for one purpose are turned to a new use, however, the resulting special analyses are almost necessarily less accurate than the routine analysis. It is quite probable that more intensive editing is called for and more particularly that the new objective calls for editing instructions which it would have been wrong to apply for the routine analysis. Practically the re-editing of data al-

* A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 29, 1937.

¹ "Hours and Earnings Before and After the N.R.A." by Witt Bowden, *Monthly Labor Review*, (January 1937); "Average Hourly Earnings in Manufacturing, 1933 to 1936" by A. F. Hinrichs, *Monthly Labor Review*, (April 1937).

series and to tighten up the least critical analyses. We should be constantly criticized for our inadequacies. But we must have help in educating the users of statistics or statistical analyses to discriminate.

A figure that has been estimated by a government agency tends to be regarded as "right," not merely as the best approximation which the data permit. Frequently statistical bias, i.e., a consistent type of error, is present in such approximations. But I plead for the usefulness even of such approximations, if their limitations are recognized. For example, it would cost several million dollars to discover exactly how many wage earners work more than a 40-hour week. It would have cost much more than the Bureau's budget permitted to re-edit our employment reports in order to eliminate from a count of establishments all those atypical situations in which, for example, only watchmen were employed during the pay-roll period. Should we have said that we have no information when we received a query: How many establishments and how many workers in manufacturing are working more than a 40-hour week? Or did we shed useful light on the subject, when we retabulated our individual employment reports for May 1937 to find that about two-fifths of the workers in our man-hour sample were in that half, perhaps, of the establishments in which the average hours worked for all persons on the pay roll was more than 40.0 hours per week? I know that the former figure is biased downward. The establishment figure may be biased upward; I know only that it is subject to several biases, both negative and positive.

The layman is suspicious of statistical estimates with notes on bias and error. I have talked with intelligent laymen who have insisted that there is no information on the subject of hours of work. They would gladly have accepted a figure of 42.4—or of 18.9—per cent, if only it could have been quoted as purporting to be completely right and authoritative.

We economists and statisticians are partly responsible for the layman's alternating distrust and blind acceptance of all figures. Burgess' article in the December issue of this JOURNAL should be as trite as this paper of mine. The sad fact is that we are the people who abuse each other's work. I have never yet talked to a Congressman who wanted more than a margin of safety in using an estimate: tenths serve many of his purposes quite as well as tenths of a per cent, and he knows it. The business man knows that data cannot be perfect. Every day he develops from his own experience approximations to facilitate his approach to vital problems of his business. He knows that his accounts are merely approximate; that the depreciation allowance is a guess, and obsolescence a hunch. Occasionally he is too insistent that government statistics meet standards that cannot be

achieved, but by and large, he accepts the fact that perfect accuracy is impossible. If he complains of some misuse of our data, he asks only that they be rendered more fool-proof. But with all the pomp and ceremony of the higher calculus and a language designed to perpetuate the priesthood, doctors of philosophy often forget to look behind the published figures to discover whether the final digit is significant or is merely published because there is not room in the table to indicate the range within which the value probably falls.

Let me take just one example from the field of wholesale prices. In 1935 a memorandum on *Industrial Prices and Their Relative Inflexibility* was published as a Senate Document. (74th Congress, First Session, Senate Document No. 13.) In its broad outlines it was an extremely illuminating document, and has focussed attention on the problems of social and economic policy incident to inflexible prices. Its author did not attempt to include in it a technical appraisal of the only price series which were available and which he would be the first to admit vary in accuracy as measures of particular price changes. I am just wondering whether automobile prices are being discussed in the fourth Round Table this afternoon! I am sure that there the discussion will be discriminating. But many of those who jump from this Senate Document to the attack, apparently fail to recognize that neither the author of the memorandum nor, I believe, the Department of Agriculture was responsible for its publication. It was intended for study in connection with the development of broad lines of policy. It therefore presumably included rough edges which would have been eliminated in developing a document for widespread public use.

The automobile industry feels abused when it is knuckled with one of the roughest of these. On page 8, there is a list of industry groups contrasting drops in price and production from 1929 to 1933. Agricultural prices declined 63 per cent while production declined 6. Let me cite two of the contrasts presented. Motor-vehicle prices are said to have dropped 16 per cent and production 80 per cent; cement prices dropped 18 per cent and production 65. There was certainly an uncritical use of our prices in this contrast. In the case of cement, we price a standard product from six producing areas which are the same in 1937 as they were in 1926. In the case of motor vehicles, we tend to compare the price of a streamlined, all metal, 85 horsepower car in 1937 with that of a Model "T" Ford in 1926. In the one case it was accurate to say that the price of cement decreased by 18 per cent from 1929 to 1933. One may carry the contrast over even a longer period and say that its price in June 1937 was 4.5 per cent less than the average price in 1926. But in the case of passenger automobiles one must say rather that it was possible in June 1937 to buy a fleet made up of various 1937

models produced by Buick, Cadillac, Chevrolet, Dodge, Ford, and Packard for the same price that one would have had to pay for an equal number of cars in 1926. I have not the faintest idea whether this means that automobiles are reasonably or unreasonably priced. Over short periods we know their prices to be relatively inflexible. Over long periods we have always admitted our ignorance of everything except the relative price that a man had to pay for an automobile in 1926 and in 1937. That we do know. We have never pretended to know quantitatively whether the car ran more miles with less upkeep, whether it used more or less gasoline and oil at a given speed, whether it would go twice as fast and, if so, how safely and comfortably.

No one in the world has yet devised a standard car value. The Bureau is continuing to work with the industry to find a more consistent measure of use-values than a name plate. The automobile industry uses wheel-base and horsepower as two of their approximate measures of value to the consumer. The industry also uses retail price per pound of car as a means of checking price policy against cost factors. They have produced an index of the retail prices per pound of car from 1929 to date. Similarly, they have compiled an index of the costs of raw material purporting to be weighted according to the quantities of the materials used in car manufacturing and also an index of factory wage rates per hour. I am unable to vouch for the accuracies of the computations or to appraise all the limitations of these indexes. It is significant, however, that while our wholesale price index of passenger automobiles fell 13 per cent from 1929 to 1933, the index of retail prices per pound of car appear to have decreased 25 per cent, while material costs decreased 37 per cent, and wage rates per hour 12 per cent. Comparing the year 1933 and 1936, they find no increase in the price per pound of car, a 24 per cent increase in material costs and a 27 per cent increase in factory wage rates. Our index of passenger car prices advanced 3.8 per cent.

You may well ask, as the automobile people have, why one publishes an index of automobile prices. We have published each month since the automobile figures were added to the wholesale price series in 1927 a longer title than is used for any other item: "Passenger cars, weighted, average price of Buick, Cadillac, Chevrolet, Dodge, Ford, and Packard, f.o.b." The method used in compiling the index has always been described in detail to users who have inquired. The listed f.o.b. prices for the various models of each make are treated through a simple average. These simple averages are weighted in accordance with the registrations of the make during the corresponding Census year for which other weighting factors are devised. We have used the same weights since 1934, and in the case of automobiles these are average

registrations in the Census years 1929 and 1931. We are now adding a footnote in the *Wholesale Price Bulletin* to the effect that: "The index is computed by dividing the aggregate weighted value for models priced currently by the aggregate weighted value in the base period (1926) for models current in 1926." If that warning still proves inadequate and we cannot discover a more satisfactory technique of measurement, it may be necessary to discontinue publication of this figure.

But bad as the relative price for automobiles is from the point of view of comparing 1926 and 1937 values and prices, the discontinuation of such figures would represent a step backward in our price work. In 1926 our index was subject to the valid criticism that finished goods prices were under-represented. The revision in 1927 extended the list of average prices from 404 to 550 commodities. Another revision in 1931 brought the list to the present number of 784 commodities. We need to go forward to the improvement of our index as a measure of long time changes in the level of wholesale prices. It ought not to be necessary to retreat from acknowledged imperfections in the technique of historical analysis, that will after all sustain a considerable margin of error without invalidating its broad usefulness, to a technique that gives poorer results over the short run.

From month to month our method of pricing automobiles is valid. From year to year it may conceivably be better than the "weight" basis. The elimination of weight without loss of strength might be represented as a distinct improvement from the consumer's point of view. From October 1936 to October 1937 our passenger car index advanced 8.0 per cent, while the Automobile Manufacturers Association figures show an increase of 10 per cent on a wheelbase index, of 12 per cent on a pound basis, and of 15 per cent on horsepower. The objection to our index for automobiles is not that it seriously misrepresents changes over short periods of time from any point of view; but that cumulatively its bias eventually results in nonsense from some points of view, notably when it is used to appraise pricing policies and costs of the elements of production or to appraise use-values.

The Bureau has as its first objective the publication of a general index of wholesale prices that will reflect from month to month the changes which are taking place. I wish to call your attention merely to the movements which occurred from the summer of 1936 to the present time to justify this broad and short-run objective. If you will further examine over this period the movements in raw material and finished goods prices, imperfect as these indexes still are, I think you will agree with me that the Bureau's wholesale price index is one of the most important measures for current economic analysis which we possess. As to the quality of the general index, I quote from Dun and Brad-

street, Inc., announcing on December 8, 1937, the discontinuation of their two indexes of wholesale prices, one of them the oldest in the country:

The decision to discontinue these two indexes was based on the belief that their service to the public had been fulfilled. . . . The Index Number of Wholesale Commodity Prices, compiled by the Bureau of Labor Statistics, United States Department of Labor, Washington, D. C., has been constructed in accordance with the most recent improvements in technique. Now available weekly, this index has a more representative coverage, and employs weights in closer alignment with the current significance of the commodities involved.

As a by-product of serving our primary objective, we possess materials which are capable of reflecting broad changes in the level of wholesale prices across long periods of time, and individual price series which measure changes in the prices of particular commodities across both short and long periods. It has always been part of the Bureau's policy to publish the components of this index so that the limitations of the total index may be appraised and so that statisticians will have available the basic data required for special computations and analyses.

The index has been revised on many occasions and is undergoing fundamental revision at the present time. We were fully aware in 1927 of the difficulties which would attach to the measurement of wholesale prices of many fabricated articles subject to changing specifications. On the whole, we feel extremely gratified with the results. To a larger extent each year we are working out with the industries involved detailed standard specifications for the items to be priced.

In passing, let me note that even on basic commodities one must admit new specifications, if wholesale prices are wanted which relate to the current market. For example, corn was priced for many years on the No. 2 white which I believe is still the standard specification on the futures exchanges. Actually, however, less than 2 per cent of the corn sold is No. 2 white. The Bureau, therefore, dropped prices on No. 2 white and is pricing No. 2 yellow and No. 3 yellow. It is not difficult with a series of that sort to secure as long a period of overlap as may be desired to establish a normal relationship between the price of a commodity meeting one specification and that of the one meeting the new specification.

Even in the case of clothing we are able to price standard commodities and to change specifications only after overlapping data have been accumulated. This does confine our prices to relatively standard items such as men's blue serge, with quotations for the 13-ounce serge on the 3-piece suit and for the 15-ounce serge on the 4-piece suit. Until recently there was a lack of detailed specifications in underwear but

we believe that this problem has been solved for the next few years in cooperation with the Underwear Institute. Because of the general adequacy of our textile price series, we can evade the problem presented by women's dresses which we do not attempt to price at wholesale.

I have not time to appraise all of our series. But let me call your attention to the fact that comparative prices for a few items are maintained through the confidence of manufacturers. Several manufacturers assign a new model number which is priced up or down rather than frankly stating that the price of the old model has been changed. We have been advised to carry the new prices without adjustment. Where the old model has been discontinued and a fundamentally new model has been introduced, they have worked out with us an appropriate allowance for cost change so that the two series of prices may be tied together.

This leaves us with a surprisingly long list of our 784 commodities which either are priced to constant specifications since 1926 or to changed specifications with long enough periods of overlap so that the index of price may be regarded as representative of long periods of time. For most items our problem consists in being sure that we are pricing an adequately representative list of items.

But it follows as a matter of course, as we subdivide our materials into separate price series, that we emerge with a number of series which are weaker than the all-commodities index or than the index for any major subgroup. Over long periods of time the biases inherent in some of the individual series are likely to become so serious as to make it improper to use them in isolation. The presence of such biases even distorts the general index for historical comparison, but we believe not so seriously as it would be distorted from month to month and from year to year were we to omit entirely certain types of product.

Finally let me relate the problems of the wholesale price index to the need for conservatism in revising price indexes. You have probably all of you criticized our present cost of living index based on 1917-19 weights. You point to the growth of the popular use of automobiles and radios, neither of which is included in our present indexes. We have completed the basic field work and tabulations that are prerequisite to reweighting this index, I am glad to say. But I must add that I am thankful we never had the headache of pricing radios during their period of rapid evolution, nor do I wish to see new commodities included in any price index until they emerge from the first period of surging development and have become relatively standardized at least from one year to the next. I at least want to take my biases in amounts that I can assimilate!

Here then is the question I wish to leave with you: Shall government agencies try to exploit their materials to the limit? Shall we frankly indicate the limitations of the data but push their use so long as the margin of error is permissible within the special use to be made of the data? Or shall we retreat to the point where the data can hardly be misrepresentative, no matter what the use to which they are put? It's a long retreat and will draw the shades of night over large segments of our economy that have at least come out into the twilight. Public opinion may decide the issue, but it is likely to be guided by the restraint we statisticians and economists exercise in vending our services. The world cannot be saved by enthusiasm. I doubt that even selfish interests are well served through the abuse of data. As Burgess remarked, the essence of statistical economic analysis remains: "Grub—grind—graph—and guess."

I plead for the value of materials on which guesses are properly made after adequate grubbing. Let me remind you again that the degree of accuracy called for depends upon the problem in hand. Precisely because people so often insist upon using figures without regard to their limits of accuracy, the Bureau has found it impossible to develop an estimate of unemployment. In some connections a five per cent error might be quite serious. But for many purposes, as in the formulations of the broad outlines of public policy, an estimate accurate within even ten per cent would do. It has never been useful to quarrel about precisely how many persons were unemployed. It has been terribly necessary to concentrate all our attention on the broad lines of policy that would be indicated almost equally well by any carefully constructed estimate.

I hope for the day when bias and error will not be terms of opprobrium, but will be recognized as attaching in greater or less degree to every statistic. We can make progress in spite of the presence of small, consistent, and cumulative errors in our data: i.e., of statistical bias. We must at times accept it as inevitable. But it should be appraised by every user, and use of the data should always be limited to problems in which the indicated margin of error is permissible. Even when appropriately used, the reader should be warned of the character of the error. If we ourselves are careful enough, we may expect to get across to the lay mind the distinction between statistical bias and biased statisticians.

The staff of the Bureau of Labor Statistics is at your constant service to explain the limitations of our data. Our doors are open at all times to those who will help us in the improvement of our materials.

SOME MEASURES OF CHANGING LABOR PRODUCTIVITY AND THEIR USES IN ECONOMIC ANALYSIS*

BY DAVID WEINTRAUB¹
W.P.A. National Research Project

THE WORKS PROGRESS ADMINISTRATION's National Research Project has undertaken a study of changing industrial techniques as they relate to changes in employment and unemployment. During the time at my disposal it would be impossible to do more than suggest the wide range of statistical material with which we have been working, and I have therefore restricted this discussion to a group of questions related to measures of labor productivity.²

The data are preliminary and should be regarded merely as examples illustrating in each case a different type of analytical problem which required the construction of either a special measure of productivity or a measure for a special segment of an industry or both. The examples have been selected to show the need for detailed statistical data in order to throw light on relationships which are obscured by over-all statistical series.

For illustrations I have drawn from the work materials and preliminary reports of various sections of the Project's work.³ Detailed statements concerning the methods used in constructing the several series will eventually become generally available with the publication of the forthcoming reports.

MECHANIZATION OF A PRODUCTION PROCESS

My first illustration is drawn from the bituminous coal industry and is intended to illustrate some relationships between the mechanization of the coal loading process and the amount of labor required per ton of coal mined underground. A study of the effects of technological changes on production and employment in the bituminous coal industry has to take into consideration not only its own competitive fields of production with their competitive wage structures, prices, transportation costs, union and non-union fields, nature and degree of mechanization, but also the competitive fuels of oil, gas, and water power. Such a study is now indeed being made.⁴ This study recognizes

* A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 28, 1937.

¹ In the preparation of this paper I was assisted by E. J. Stone and H. Ober.

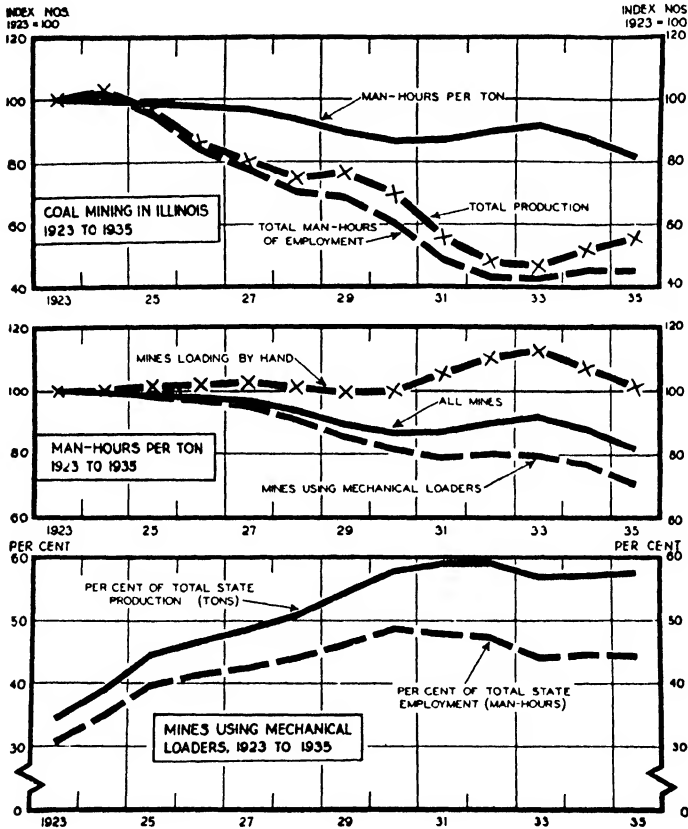
² For a statement of the general approach to the Project's assignment, see Irving Kaplan, *The Research Program of the National Research Project*, (W.P.A. National Research Project, August 1937).

³ The research work of these sections is under the supervision of Irving Kaplan, Associate Director of the Project.

⁴ Under the direction of F. G. Tryon. This is one of a group of studies undertaken by the Project in cooperation with the U. S. Bureau of Mines, with O. E. Kiessling of the Bureau in charge.

all the factors just mentioned, and more, as analytical points of departure. In order to throw light on the effects which these factors have on the industry, the available factual material has been tabulated accordingly.

CHART 1
MECHANIZATION OF A PROCESS AND PRODUCTIVITY
(3 year moving averages)



During the past dozen years or so, mechanization of the coal loading operation has become an important problem in the industry. The installation of these labor saving devices results not only in greater output per unit of labor, but brings about considerable changes in the operation of the entire mine, effects a more minute division of labor, and though it may not result in a reduction of the total number of workers employed, it frequently requires changes in the type of personnel in order to obtain workers more adaptable to the new tempo of

operations. It was therefore desirable to analyze the production, employment and productivity data, where possible, separately for mines which had installed the loading machines and mines which had not.

Chart 1, based on statistics for the State of Illinois, shows in the upper panel that between 1923 and 1929 production declined 22 per cent and man-hours worked 32 per cent. Further declines since then have resulted in 1935 figures of production which were 42 per cent below 1923 and of man-hours which were 55 per cent below. The differences between the relative reductions in output and employment represent increases in productivity, which, when measured in terms of man-hours required to produce a ton of coal, amounted to 19 per cent between 1923 and 1935.

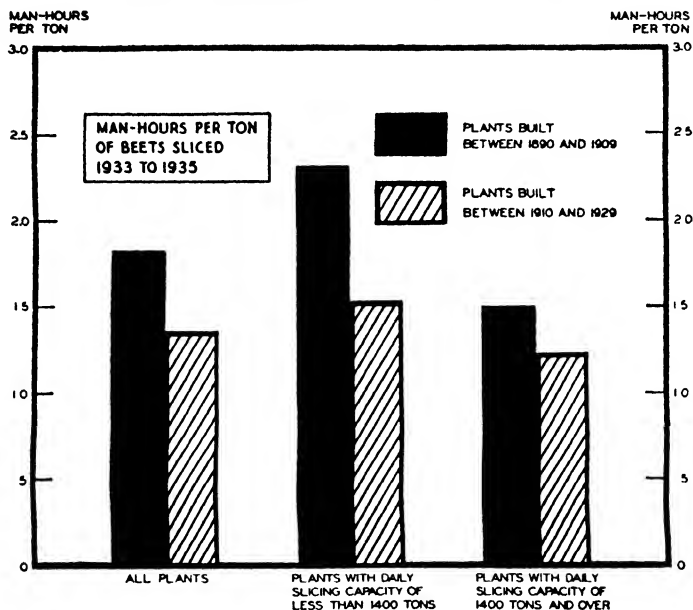
There is no doubt that this decline in the labor required per unit of output reflects the progress of mechanization of the loading process. This can be observed in the center panel of the chart. The solid line again represents the average man-hours of labor required to produce a ton of Illinois coal. It covers all underground mines in the State. The upper line represents a similar measure for all those mines which continue to load by the old hand process. There was practically no change from 1923 to 1935. The lower broken line on the other hand shows a decline of about 30 per cent. This line represents the average man-hours of labor required to produce a ton of coal in those mines which had mechanized the loading of 30 per cent or more of their output between 1923 and 1935. It should be noted also that it is these mines which in the general drop of Illinois coal production lost less than their share both in output and in employment. The lines in the bottom panel show that in 1935 the mines which installed mechanical loading equipment produced 58 per cent of the coal and used 44 per cent of the man-hours, as against 34 per cent of the coal and 31 per cent of the man-hours in 1923. These lines include all of these mines for the entire period 1923-35, regardless of the date of the installation of mechanical loading equipment.

It cannot be said, of course, that the decline of 30 per cent in the unit labor requirements measures the labor saved by mechanical loading, or that the mines which have not installed the loading equipment could all economically do so. It should be clear, however, that no analysis which must confine itself to the over-all statistics shown in the top panel could even begin to grapple with the problems of the Illinois coal industry, and that a fuller understanding of these problems requires detailed statistical data and the construction of productivity measures as well as other measures, all designed with reference to the specific analytical problem at hand.

SIZE OF PLANT

The next illustration concerns the relationship between size of plant and labor requirements per unit of output. It is drawn from the preliminary results of our study of the beet sugar industry.⁵ A feature of the beet sugar industry is its universal practice of operating plants at full speed and 24 hours a day during what is termed the "campaign" period, i.e., from the time the first beets are received from the fields until the entire supply is exhausted some weeks or months later. Thus

CHART 2
LABOR REQUIREMENTS AND SIZE OF PLANT



plant size or plant capacity in this industry is properly expressed by a measure of average daily operations. We have chosen the number of tons of beets sliced as our measure of operations.

Chart 2 was prepared from a cross-classification of the 1933-35 average campaign labor requirements per ton of beets sliced in each of the 66 plants in our sample. The chart shows man-hours used per ton of beets sliced in plants of varying size and age. It is clear that the older plants used more labor per unit of raw material consumed than the newer plants and that the smaller plants used more labor than the larger ones.

⁵ The study was done by Raymond K. Adamson and Miriam E. West under the direction of Harry Jerome and William A. Neiswanger. It is one of a group conducted by the Project in cooperation with the National Bureau of Economic Research, Inc.

We know from other information that in this industry large size of plant is associated with low unit cost of production. For the purpose of determining employment prospects in the industry, we therefore wanted, among other data, information on the present trends in plant construction and plant mortality according to the size and age of plant. Although we have some data indicating that the abandoned plants have been smaller than the average size of operating units, such other information as we have leads us to conclude that the increase in the size of plants over the past 20 years has been due more to a gradual improvement in capacity in all plants than to the erection of new large plants and abandonment of old small ones. From another study on methods used in the raising of sugar beets,⁶ we also found that there was a pronounced tendency toward the adoption of trucks for hauling beets to the factory. This meant that one factory could economically receive the product of a larger farm area, and was therefore impelled to increase its slicing capacity. Further, an analysis of machinery and equipment installations suggests that the past 20 years have been characterized more by the perfection of existing methods and the adaptation of precision control of operations than by technical changes of an order necessitating the construction of new plants.

PER CENT OF PLANT CAPACITY PRODUCED

In the discussion of the beet sugar industry, it was pointed out that the industry operates its factories either at capacity or not at all. This is of course the case in very few industries.

In the brick manufacturing industry,⁷ among others, we found it necessary to determine the ratio of output to total capacity in order to interpret the movement of labor requirements per unit of product. The upper line on Chart 3 represents an index of average man-hours utilized per 1000 bricks produced in the plants covered by our field survey. Productivity has been declining since 1925. The major cause of the decline seems to have been not deterioration in equipment or technology, nor a major change in the nature of the product, but a decline in the per cent of capacity produced, represented by the line on the lower part of the chart. Clearly, there is an inverse relationship between unit labor requirements and the degree of capacity produced. When unit labor requirements are adjusted for changes in capacity produced they become the third curve on this chart, which indicates that, for our sample of the industry, the man-hours needed to produce

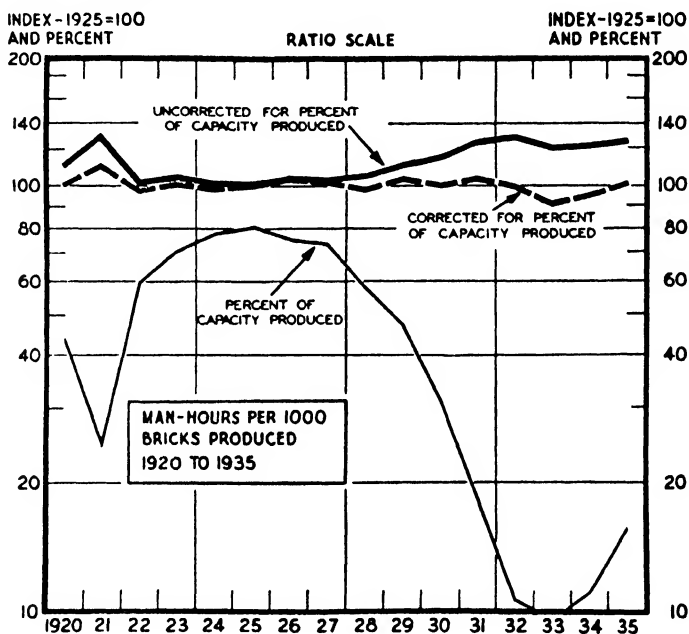
⁶ Loring K. Macy, Lloyd E. Arnold, Eugene G. McKibben, and Edmund J. Stone: *Changes in Technology and Labor Requirements in Crop Production - Sugar Beets*, (W P A National Research Project, August 1937).

⁷ The materials for this discussion were taken from a preliminary report on a study, conducted in cooperation with the National Bureau of Economic Research, Inc., prepared by Miriam E. West under the direction of Harry Jerome and William A. Neiswanger.

1000 bricks remained approximately constant throughout the period.

This correction was necessary in order to permit us to examine the net effect of changes in plant methods and equipment and management. We found that if these plants had operated at reasonable proximity to capacity in 1935, they would have used about as many hours of labor per unit of product as they did 15 years ago. Secondly, we found that, in the case of the brick industry, employment and

CHART 3
LABOR REQUIREMENTS AND PER CENT OF CAPACITY PRODUCED

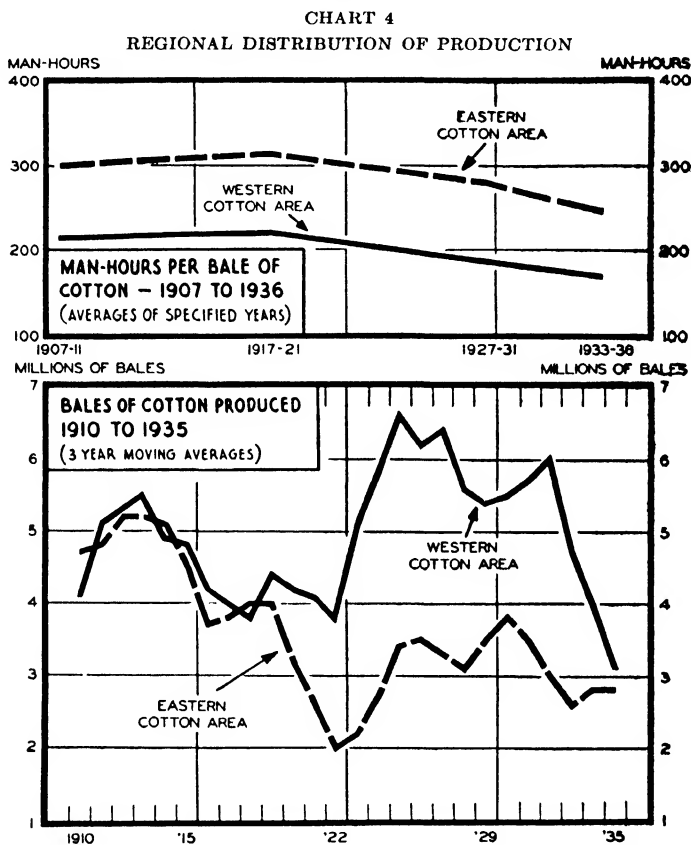


production practices are such that the relation of output to capacity is of overwhelming importance to an evaluation of employment prospects: under the present circumstances, an increase in output would be accompanied by a very much less than proportionate increase in man-hours of employment.

REGIONAL DISTRIBUTION OF PRODUCTION

Another problem frequently confronted in productivity analysis is represented by regional differences in the absolute level, or the direction or rate of change, of man-hour requirements per unit of product. Such differentials are frequently concealed by over-all data, yet have important implications from the point of view of employment prospects in given localities.

As an illustration, production and unit labor requirements for two important cotton producing areas are plotted on Chart 4.⁸ The two upper lines, which represent man-hours per 500-pound bale of cotton produced, exhibit a fairly constant absolute differential. Throughout the quarter-century, the western area (the States of Texas and Okla-



homa) has used substantially less labor per bale than the eastern area (the States of Alabama, Georgia and South Carolina). The two lines on the bottom of the chart show cotton production in the same areas during the same periods. Production in the western area jumped about 40 per cent between the 1917-21 and the 1927-31 periods, and even in 1933-36, when affected by droughts and the A.A.A., it was only slightly below its 1907-11 level. In the South Atlantic states, on the other hand, we see a steady decline in total output, amounting

⁸ The materials for this discussion were taken largely from a study prepared by William C. Holley and Lloyd E. Arnold. The study is one of a series on changing techniques and employment in agriculture, conducted under the supervision of John A. Hopkins

by the end of the twenties to more than 20 per cent and by 1933-36 to about 35 per cent.

There are, of course, a great many factors which contribute to the differential in productivity. A few of these may be pointed out. In the first place, farms in the western area are considerably larger than in the eastern area and use larger, more efficient equipment and use it more extensively. By and large, western farms do not need to be fertilized, while the cotton crop in the old South, grown on depleted soil, is a heavy consumer of commercial fertilizers. Again, rainfall in the western area is relatively low; consequently hoeing and cultivating are less often required than in the eastern area, where these operations continue to consume large quantities of hand labor.

Finally, there are important differences in labor requirements for harvesting. In the western area the cotton bolls ripen more nearly at the same time and one or two pickings are common practice, whereas in other sections two or three pickings are necessary. Also, cotton in the southwest is snapped off, boll and all, rather than picked from the boll, as in other areas. This means substantially faster harvesting.

Because there are differences in the quality of the harvested product and differences in various cost elements, such as hourly wages, one may not conclude that the competitive advantage of the western area is measured exactly by the relation between the two lines on the top of our chart. And although the boll weevil, soil erosion, relative profitability of alternative crops and a number of other factors have influenced the shift of cotton production from the East to the West, there is no question that the difference in labor requirements is an important element accounting for the diverging production trends.

CHANGING COMPOSITION OF TOTAL PRODUCTION

The last illustration concerns the problem of constructing a measure of productivity in an industry in which the composition of its composite product changes. Few industries produce a single standardized product. Some produce several major products and, in addition, minor products or by-products. A productivity measure for such an industry should take not only this fact into account but the even more important fact that the proportions which the several products constitute of the industry's total production keep changing.

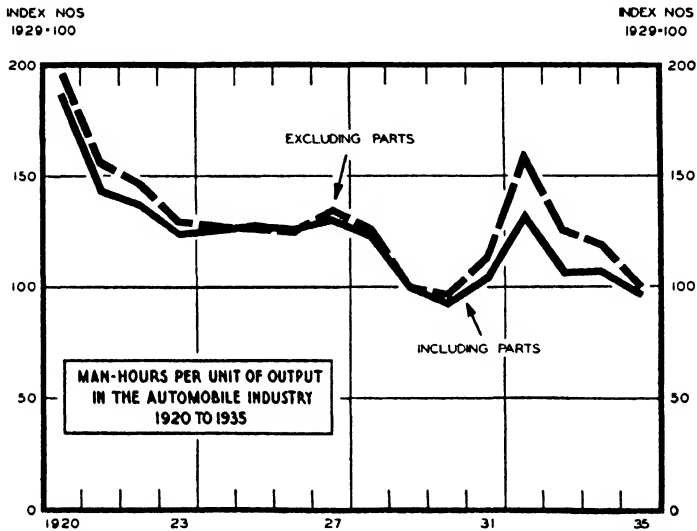
Chart 5 illustrates this point.⁹ The physical volume of production of the automobile industry is almost always measured in terms of the number of cars produced or sold.¹⁰ However, the available employment

⁹ The data for this chart were prepared by Leo Genseloff and are taken from one of a group of productivity studies, based largely on secondary sources, which the Project is conducting with Harry Magdoff in charge.

¹⁰ This measure is sometimes weighted for the number of open and closed cars, trucks, busses, etc.

statistics for the industry include, besides those engaged in the manufacture of cars, those engaged in the production of parts. Unless the ratio between the production of cars and parts remains approximately constant, the index of productivity is bound to be distorted by this change in the composition alone. In order to keep the example clear, I am here passing over some rather fundamental problems concerning the several sizes, price classes, functional and other differences of automobiles. The fact is that in most years the ratio between the production of parts and cars is fairly constant, with parts fluctuating between

CHART 5
PRODUCTIVITY AND COMPOSITION OF PRODUCTION



12 and 16 per cent of the total dollar value. During the depression years, however, the production of parts rose to more than a quarter of total production. Unless this factor is taken into account, the productivity measures for depression years are considerably distorted, as evidenced by the spreading of our curves in these particular periods.

The corrections shown on the chart are by no means the most important corrections that must be made in order properly to represent the changes which took place during the period. Without a detailed field study it cannot, for instance, be determined what if any effect the consolidation of companies and the integration of production had on labor requirements; or what the influence was of reduced operation during the depression; or the effects of changes in certain production processes; etc. Unfortunately, we have not found it possible to make such a study in this industry.

CONCLUSIONS

In presenting these illustrations I have either implied or explicitly stated that over-all measures of productivity obscure many economic factors which operate in the respective industries and consequently do not permit meaningful analysis of the factors which make for productivity changes unless some way is found to get below the over-all figures and at the many relationships which control the when, why and how of technological changes. Our Project has conceived of technological change as a problem which cannot be studied apart from its context of historical and economic relationships. These relationships cannot, however, be observed or derived from over-all statistics. It was only in the Bureau of Mines' files on extractive industries that we found sufficiently detailed information, covering a long enough period of years, to permit reasonably appropriate analyses. In most other instances it therefore became necessary to arrange intensive field studies and to collect data based on individual plant histories.

The problem which presents itself when we attempt to interpret the movement of a productivity index which covers a group of plants within a single industry becomes of course much more complex when the index covers a composite group of industries and represents a sector of the economy, such as agriculture, or manufacture.

Our industrial economy is characterized by the continuous growth and decline of industries, services, occupations; by the depletion of old and tapping of new resources; by the rise of new centers of economic activity and the haunting ghosts of old ones. This is true in the mining industries, it is true of the manufacturing industries, and in agriculture and transportation. While some of the story is evident even from an inspection of over-all figures, it is only a detailed analysis which makes possible more precise statements concerning the incidence of these industrial changes, their effects in terms of places and people, and their probable future course.

My thesis therefore is that a study of the effects of technological changes must wherever possible get below the over-all labor productivity measures. Only so is it possible to evaluate the effects of those elements which, when analyzed, may help to interpret movements in the over-all series and to evaluate trends and prospects of employment in various industries, occupations and regions.

I have illustrated this thesis with selected examples of interrelationships which are of analytical importance in particular industries. It is impossible to understand the fluctuations of productivity in the brick and tile industry without considering the degree of capacity utilization; in cotton culture, regional differences in size of farm, topog-

raphy, soil fertility, and climate result in different productivity levels and diverging production trends; an interpretation of productivity changes in coal extraction must take into consideration the differences in kind and degree of mechanization as well as the physical conditions of the mines; and so forth.

Technological change, then, cannot be posed as simply a question of machines versus men. The term "technological change" must be interpreted to include not only machines which do work done yesterday by men, but also machinery, equipment and instrumentation which do more work than men were able to do yesterday, or which do work that men could not do yesterday. It must include non-mechanical changes involving the management of production and labor, the flow and organization of work, and such structural changes as the integration and consolidation of plants, the development of new and competitive products, resources and areas.

As technological change cannot be dissociated from related aspects of the economy, so the technologically unemployed man cannot ordinarily be labeled. Technological developments not only assume different forms but have different effects on employment and unemployment according both to general economic conditions and to the specific economic conditions surrounding the occupation, industry or area affected. Measures of changing productivity are only one of the tools used by the Project. These measures help us to throw light on the effect of changing technology on the security of employment and the incidence of unemployment. As new industries and new plants come into being, while others contract their scale of operations, and still others shift their location, these industrial changes leave groups of workers jobless in one industry or area and expand the demand for labor in another part of the economy or country, or they change the nature of the job specification for employment at particular tasks and so impose occupational adjustment on workers.

The failure of our economy to provide full and remunerative employment for all those willing and able to work, while millions live at the bare subsistence level, constitutes the major problem of our day. Productivity measures have a place in the study of this problem and serve to throw needed light on the effects of changing technology.

SOME RECENT RESULTS IN POPULATION ANALYSIS*

BY ALFRED J. LOTKA, *Assistant Statistician*
Metropolitan Life Insurance Company

PHENOMENA EXHIBITED BY THE POPULATION AS A WHOLE

THE STUDY of quantitative demography or population analysis can be undertaken from two points of view or by two methods—the empirical method and the rational or formal method.

The rational method is *possible* through the fact that between the various demographic characteristics there exist certain necessary relations, that is, relations imposed by the laws of physics or the laws of logic.

But the rational method is not only possible, it is *indispensable* if we wish to obtain an entirely satisfactory understanding of population phenomena. Undoubtedly the ideal process is to cultivate both methods side by side. According to our predilections, the empirical data will then be for us concrete illustrations of the abstract principles that mainly interest us; or, on the contrary, the formal relations will serve us as guides in the examination and interpretation of the empirical data which, in that case, will be our fundamental interest.

In what follows, it is proposed to indicate briefly a few examples, among more recent developments, to illustrate the relation between the two methods.

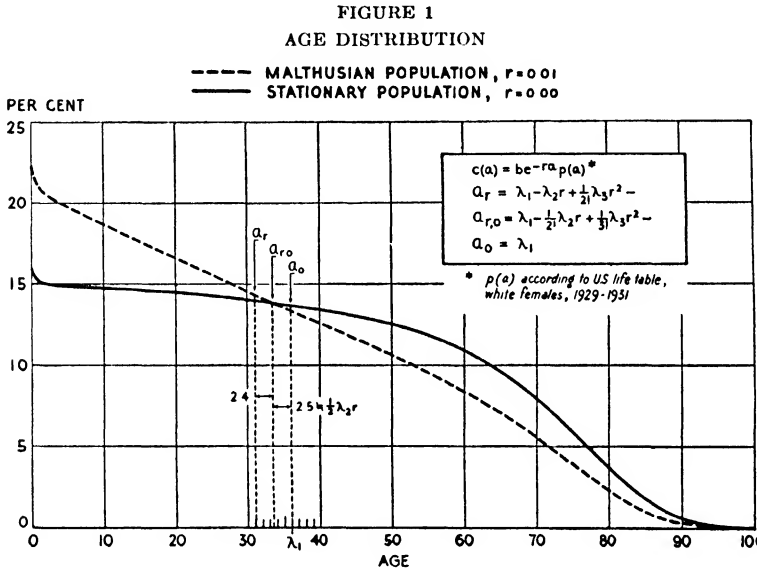
We shall begin by considering a few fundamental types of population, somewhat idealized and yet representing conditions such as are approached in some actual populations. The three types which we will consider are the stationary population, the Malthusian population, and the logistic population in relation to actual populations.

In the chart, Figure 1, there have been plotted two curves of age distribution, first, one corresponding to the stationary population on the basis of the mortality of white females in the United States 1929–1931; and, second, a corresponding age distribution curve, computed on the basis of the same mortality table, but with an assumed constant rate of increase of 1 per cent per annum. Certain points of geometric interest about these curves call for attention. A vertical line has been drawn through the point corresponding to the average age of each population, and a third vertical has been drawn through the point of the intersection of the two curves. The feature to which I wish to draw attention is that to within small quantities of second and higher order the line through the point of intersection lies halfway between the two

* Paper presented at the International Population Congress in Paris, July, 1937

verticals. It can, in fact, be shown that the distance between these verticals is, in close approximation, given by $\frac{1}{2}\sigma^2r = \frac{1}{2}\lambda_2r$, where σ is the standard deviation of the life curve about its mean and r the rate of increase of the Malthusian population.

If instead of drawing the curve for the Malthusian population corresponding to a rate of increase over 1 per cent, we drew a succession of curves of this type with successively diminishing rates of increase, we would obtain a nest of curves, the left hand portion of which would



be located at successively lower levels while the right hand portion would be at successively higher levels, as we pass from greater to lesser values of r . This is merely an illustration of the fact that a rapidly increasing population has a relatively high proportion of young persons, and that this proportion of young persons diminishes with a diminishing rate of increase in the population. The general character of these curves may be described by saying that each is produced from the one immediately preceding by a *tilting* movement about a certain point. We may ask what that point is. It can be shown that the *instantaneous center of tilt* as we pass from one of these curves to one immediately following (corresponding to an infinitesimal change in r) is located at the point corresponding to average age of the population. As we pass from curve to curve, this center of tilt moves somewhat slowly from left to right, within relatively narrow limits. So, for example, if we start with a curve corresponding to a rate of increase of

$r=0.01$ and extend the process until we are dealing with a curve with a rate of increase of $r=0.00$, then the instantaneous center of tilt will be found to have moved from age 31 to 36.

These may at first sight seem to be merely interesting geometric properties. They have, however, a practical bearing. The fact that the center of tilt lies in the neighborhood of the average age of the population implies that, as we pass from greater to lesser values of r , the natural rate of increase, the proportion of the population comprised within the age groups at the young end and at the old end of the curve of the population change materially, but the age group or groups centered about the average age of the population, i.e., essentially the group of productive workers, undergoes relatively small change.

TABLE I
AVERAGE AGE OF THE POPULATION IN UNITED STATES

	1880	1890	1900	1910	1920	1930
1 Males	25 30	26 29	26 93	27 79	28 62	29 89
2 Females	25 01	25 91	26 47	27 27	28.11	29 69
3 Malthusian	24 70	25 46	26 35	27 34	28 38	29 41
4 Malthusian	24 06	24 79	25 67	26 96	28 38	30 17

Note (1) and (2), Observed values (3) Values calculated on the basis of (a) the value of r corresponding to the year in question according to the logistic curve of increase in the United States, and (b) the life table for white females, 1919-1920 (4) Values calculated in the same way, but based on a life table as close as possible to the year in question

While we have recognized these features as special characteristics of the Malthusian age distribution it will be seen from Table I that on the one hand the average age of the actual population of the United States has tended to approach that of a Malthusian age distribution corresponding to the prevailing rate of natural increase; on the other hand, Table II shows that the proportion of persons comprised within

TABLE II
POPULATION OF AGES 20-49 AS PER CENT OF TOTAL POPULATION,
UNITED STATES, 1850-1930

Year	1850	1880	1890	1900	1910	1920	1930
Actual	38 6	40 0	41 2	42 2	44 0	43 9	44 0

the age group 20 to 49 years in the actual population has varied only rather slowly, the extreme limits being 38.6 per cent in 1850 and 44.0 per cent in 1930, an increase of 5.4 in the course of 80 years.

The Malthusian type of population, being that which prevails when the rate of increase of the population is constant, may be quite closely approached when the rate of increase of the population has been ap-

proximately constant for some time. There are several instances of actual populations of this type recorded in the literature. One of these,

TABLE III
MALTHUSIAN POPULATION
AGE DISTRIBUTION, BIRTH RATE, DEATH RATE AND RATE OF
NATURAL INCREASE, PER THOUSAND

Age groups	England and Wales, 1871-1880					
	Male		Female		Both Sexes	
	Calculated	Observed	Calculated	Observed	Calculated	Observed
0-5	142	139	135	132	138	136
5-10	118	123	114	117	116	120
10-15	107	110	104	104	108	107
15-20	98	99	95	95	96	97
20-25	88	87	86	91	87	89
25-35	150	144	148	149	149	147
35-45	117	112	117	115	117	113
45-55	84	84	87	87	86	86
55-65	57	59	63	61	60	59
65-75	29	31	36	35	32	33
75-∞	11	12	13	15	12	13
Birth rate b	36.47	36.92	33.74	33.72	35.08	35.28
Death rate d	22.16	22.61	20.01	19.99	21.07	21.27
Rate of increase r	14.31	14.31	13.73	13.73	14.01	14.01

Age groups	Germany, 1891-1900		Sweden, 1910	
	Both Sexes		Both Sexes	
	Calculated	Observed	Calculated	Observed
0-10	244	244	218	218
10-20	198	198	185	192
20-30	164	170	155	156
30-40	134	131	129	125
40-50	105	101	107	102
50-60	78	78	86	88
60-70	50	51	65	66
70-80	22	23	40	40
80-∞	4	5	15	13
Birth rate b	35.90	36.2	—	—
Death rate d	22.01	22.3	—	—
Rate of increase r	13.89	13.9	—	—

the population of England and Wales in the period from 1871 to 1880, is exhibited in Table III, taken from one of my earlier publications (1907), together with the correspondingly computed Malthusian ideal type. A similar example was later given by Bortkiewicz (1911), namely the population of Germany in 1910, and quite recently another example by Cramér, namely the population of Sweden in 1935.

These examples lend a certain practical interest to the Malthusian type of population. However, even if no actual case of this type had been observed anywhere, it would still be of serious importance, because it is towards a particular Malthusian type, the "stable" type, that any population, starting from any arbitrary age distribution,¹ would converge, if it were subject to a regime of a constant age schedule of fecundity and mortality.²

In the case of a population which has actually attained the stable form, the corresponding stable rate of natural increase is known by direct observation. In any other case it can be found only by computation.³ In a certain sense this stable rate of natural increase is a purely hypothetical quantity. It possesses no value for purposes of prediction, since the conditions (fertility and mortality) which are assumed constant in its computation, will in actuality rarely be constant. However, in another sense the stable rate of natural increase is anything but hypothetical. It is a very real measure of actually prevailing conditions. If this stable rate of natural increase has a negative value, we know that the existing conditions of fertility or mortality, or both, must be improved if the population is to escape eventual annihilation. The stable rate of natural increase is thus recognized as the measure of an intrinsic quality of the existing population; hence the alternative name "intrinsic rate of natural increase" for this quantity ρ .

In its essentially quantitative application the intrinsic rate of natural increase may be replaced fairly satisfactorily by the "Boeckh index" favored by R. Kuczynski, or by the "replacement index" of W. S. Thompson, much used by F. Lorimer. These two measures possess the advantage of being a little easier to compute, although the difficulties of the computation of the intrinsic rate have at times been exaggerated. It is true that the computation of ρ requires a few min-

¹ Provided only that the age composition of this population were not wholly abnormal, as for instance if it were made up wholly of individuals of one sex, or of individuals beyond the age of reproduction, etc.

² The author takes this opportunity to correct a faulty enunciation of this principle which has crept into the literature. The principle has been formulated in the words. "a population constantly subject to the same mortality and with a constant rate of increase must *ultimately* become stable, that is to say, have a stable age composition, a stable birth rate and a stable death rate with a constant rate of increase." The fact is that the conditions explicitly stated are insufficient to enable one to make any prediction regarding the further development of the population in question. If we supplement the enunciation in order to render the prediction determinate (by adding the condition which is implicit in the original context, that the population in question is to be subject not only to a constant life table, but also to a constant age schedule of fertility), then it is futile to say that the population will *ultimately* converge to the stable form, for under these conditions it can have none other than the stable form from the start. See A. J. Lotka, *Journal of the Washington Academy of Sciences*, Vol. 27 (1937), p. 299; and *Human Biology*, Vol. 9 (1937), p. 104.

³ Based on statistics not only of mortality but also of fertility.

utes⁴ beyond that of the Boeckh index R_0 (which incidentally is obtained as an intermediate result whenever ρ is computed). But if these few minutes are spent on the extra work, it must be remembered that an additional result is obtained which has the advantage of being directly comparable to the crude rate of natural increase, the crude birth rate and the crude death rate. Furthermore, the particular interest of the intrinsic rate of natural increase lies in the fact that it plays a very important role in a whole system of intertwining demographic relations, as I have set forth in detail in a forthcoming monograph.⁵ Among other things it leads directly to an intrinsic birth rate and an intrinsic death rate, which in many cases will differ materially from the corresponding crude rates; of these intrinsic birth rates and death rates the Boeckh index R_0 gives us no indication.

Those who favor the use of the Boeckh index have sometimes remarked that an approximate value of the intrinsic rate of natural increase can be obtained by dividing $1 - R_0$ by the mean length of generation. But it is only fair to draw attention to the fact that this idea dates from the year 1925, the time of the publication of a fundamental article on the intrinsic rate of natural increase. Neither Boeckh, in 1886, nor any of his disciples since had ever suggested this idea or recognized its implications.

The logistic population

While, as has been shown, actual populations have on several occasions rather closely approached the Malthusian age distribution, it is quite evident that in actual fact, especially in modern times, the idealized type which would most closely correspond to an actual population must be of a different character, for it must allow for the characteristic downward trend of the birth rate among the civilized nations. In point of fact, the third idealized type of population, namely that based on the logistic growth curve, has been found in one example at least to fit very well indeed the age distribution of a population, namely the native white female population of the United States in 1920, the only case for which the somewhat laborious computations have been carried out. Figure 2 illustrates this case and shows that we have here indeed a very acceptable fit.

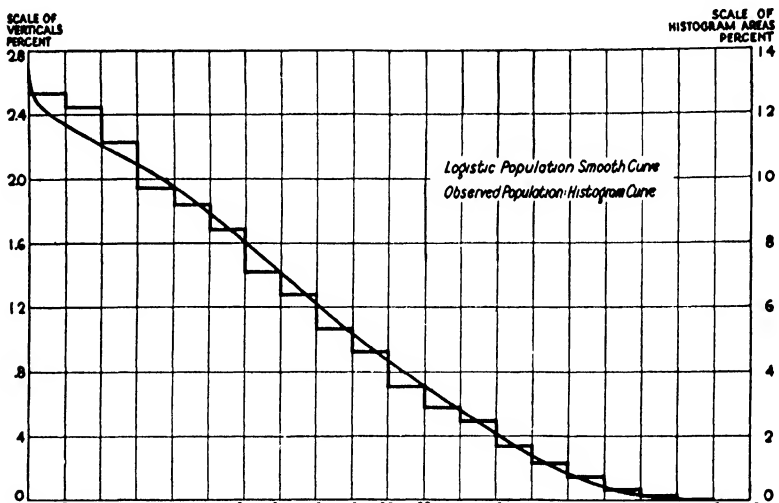
That the logistic type of age distribution should be found to fit very acceptably the population of the United States, at any rate so far as

⁴ One of my assistants, using a computing machine, carried out the additional steps in eleven minutes.

⁵ A. J. Lotka, *Théorie analytique des associations biologiques*. Deuxième partie—Analyse démographique. Hermann et Cie. Paris.

it is native born, is not surprising, considering that until recently, that is until the date of the last census, 1930, the population of the United States has in its growth followed rather closely the logistic curve. Since that date the growth curve of the United States has deviated quite appreciably from the logistic curve, as shown in the chart, Figure 3. This chart, however, really gives an inadequate idea of the extent of the departure, even though we have used an insert drawn on a magnified scale to bring out recent deviation from the logistic. This deviation is brought into much greater prominence when we compare, not the

FIGURE 2
AGE DISTRIBUTION IN LOGISTIC POPULATION COMPARED WITH NATIVE WHITE FEMALE POPULATION OF U S 1920



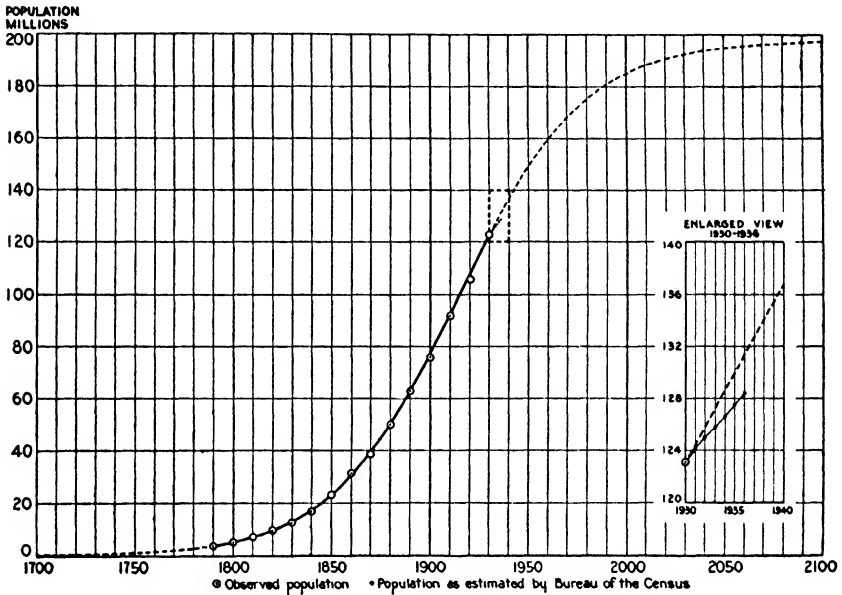
number of the population, but the annual number of births, as computed according to the logistic, and as actually observed. To this comparison we shall now proceed.

At a former Congress on population, six years ago, I indicated a method by which it is possible to compute for a closed population growing by the logistic law, on the basis of suitable mortality data, the corresponding curve of annual birth rates. Let me now present a diagram indicating a modified mode of procedure by which, not the curve of the birth rates, but that of the annual births is obtained. If over the whole stretch of time under consideration mortality had been constant it would be a relatively simple matter to compute the course of the annual births corresponding to the logistic curve of growth of the population. So, for example, if the regime had remained unchanged

as of the year about 1840, the annual births would have followed essentially the course indicated by the uppermost curve in Figure 4. Similarly had the process taken place entirely under the regime of the mortality of about 1871-1880, the course of events would have been essentially that represented by the second curve from above, etc. Actually, the process has proceeded under the regime of successive mortality

FIGURE 3

LOGISTIC GROWTH CURVE APPLIED TO THE POPULATION OF THE UNITED STATES
AND COMPARED WITH THE POPULATION ACCORDING TO CENSUS DATA,
1790-1936

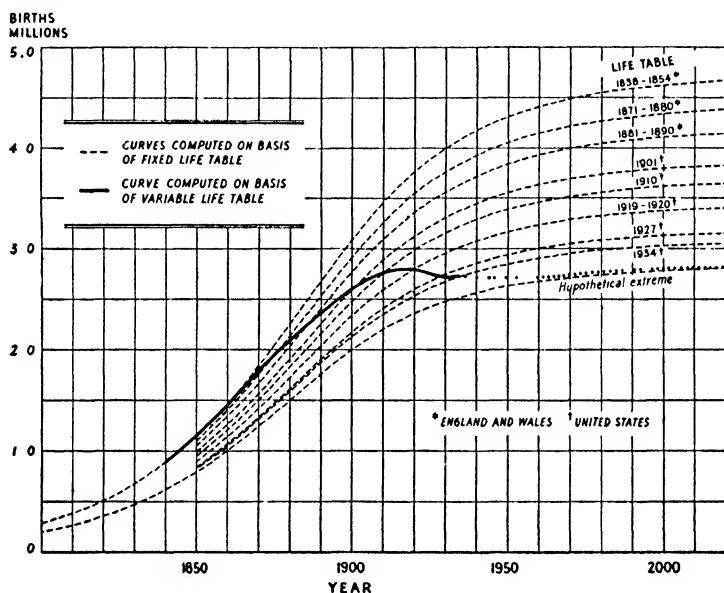


rates, and the corresponding annual births, if the population had grown entirely by excess of births over deaths, would have been essentially that represented by the heavily drawn curve which crosses the nest of approximately parallel curves.

An inspection of the heavily drawn curve so obtained brings out an interesting feature. At a certain part of its course, after attaining a maximum about the year 1918, the curve drops downward slightly for several years. The reason for this temporary dip is that the curve of annual births has been computed for a series of mortalities improving from year to year, and improving very rapidly in the recent past, with the result that the curves drawn on the basis of recent mortality tables are situated at successively lower levels. However, there is a

limit to what we may hope to accomplish further. It is not likely that the mean length of life can be increased much beyond 70 years. The lowermost curve, inserted to complete the diagram, and not by way of prophecy, has been drawn on the basis of a hypothetical⁶ life table corresponding to a mean length of life of 70 years. The continuation of the curve of annual births beyond 1934 is indicated in Figure 5 by the

FIGURE 4
ANNUAL BIRTHS COMPUTED FOR A CLOSED POPULATION GROWING ACCORDING TO THE LOGISTIC LAW WITH THE CHARACTERISTIC CONSTANTS OF THE UNITED STATES, AND ACCORDING TO SEVERAL LIFE TABLES



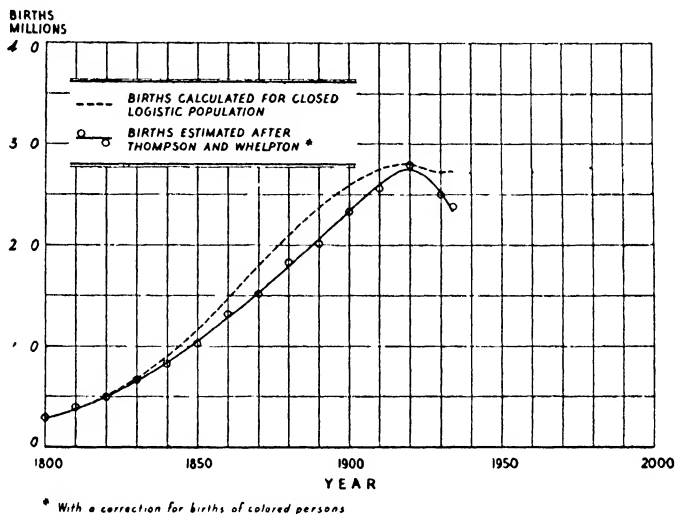
dotted curve. This curve represents the lower limit which cannot be crossed by the annual births in a closed logistic population, so long as the mean length of life remains limited to 70 years.

Such would be the course of the annual births in a logistic population possessing certain of the fundamental characteristics of the population of the United States, but growing exclusively by the excess of births over deaths. Actually the evolution of our population has followed a different line, more particularly in that it has received very notable accretions by immigration. Let us then examine how the actual course of events compares with the curve of annual births in a closed population growing according to the logistic law.

⁶ According to Louis I. Dublin and Alfred J. Lotka, *Length of Life—A Study of the Life Table* (New York: The Ronald Press Company, 1936).

The official statistics of births in the United States is of relatively recent origin. It dates only from 1915. However, on the basis of the enumeration of children under 5 years of age in decennial censuses, making due correction for deaths, it is possible to obtain an approximate estimate of the annual births. This is the method employed by W. S. Thompson and P. K. Whelpton,⁷ the results⁸ of which are indicated by the small circles in Figure 5. The points so plotted have been

FIGURE 5
COMPARISON OF "ACTUAL" ANNUAL BIRTHS IN THE UNITED STATES
(AS ESTIMATED BY THOMPSON AND WHELPTON) AND CURVES
COMPUTED FOR A CLOSED LOGISTIC POPULATION



fitted by the graphic method with a curve shown in full line in the drawing. The curve of dashes in Figure 5 is a direct copy of the curve of logistic births of Figure 4.

It will be seen that about the beginning of the nineteenth century, the curve of actual births (as estimated by Thompson and Whelpton) fuses with that calculated on the basis of the logistic law. Then comes a period up to about 1920 where the curve of actual births falls a considerable distance below that calculated according to the logistic law for a closed population, which is entirely proper since in actual fact immigrants from abroad have added their numbers to the accessions

⁷ Population trends in the United States 1933, page 262.

⁸ Thompson and Whelpton's results were, however, for the present purpose, modified by the inclusion of an estimate of colored births, which were not included in the figures of these authors. Also, the number of births for the year 1934 (the last point on the curve in Figure 5) was obtained by a special calculation based on actually registered births; in other words, this particular point is based on more recent data than were available to Thompson and Whelpton at the time they made their estimates

to the population by births. In late years immigration to the United States has been arrested, and quite recently immigration has actually given way to slight net emigration.

The significant feature strikingly brought out by the diagram is that at the period when the logistic curve of births exhibited a gentle downward dip, the curve of actual births has shown a very sharp decline, and this at the very time when immigration not only touched the zero mark but became a negative quantity.

A little while ago, when we inspected the curve of population growth, we found that since 1930 it had deviated on the short side of the logistic curve, but the deviation in that case began only in 1930, was relatively slight and we had to use an insert drawn on a magnified scale to show it clearly. There is no need of any magnification of the curve of births to show the very strong departure from the logistic which has taken place.

Differential growth rates: The employable age groups

In a population in stable age distribution, all the elements increase at the same per cent rate, and the relative proportion of the several age groups is constant. In the logistic population, on the other hand, older age groups increase more rapidly than the younger, in fact, the

TABLE IV
RATE OF INCREASE OF POPULATION IN EMPLOYABLE AGE GROUPS IN RELATION
TO RATE OF INCREASE OF ENTIRE POPULATION, UNITED STATES, 1850 TO 1950

Year	Population, thousands, by Age			Population ages 15-69 as per cent of total	Average annual per cent in- crease in population from preceding entry			Ratio col (6) col (5)
	All ages	15-69	Under 15, also 70 over		All ages	15-69	Under 15, 70 and over	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1950*	141,098	100,458	40,640	71 20	.604	.533	.782	.88
1945*	136,962	97,851	39,111	71.44	.697	.853	.317	1 22
1940*	132,350	93,840	38,501	70 91	.767	1.241	-.335	1.64
1935†	127,521	88,365	39,156	69 29	.774	1.354	-.383	1.75
1930	122,776	82,761	39,920	67.46	1.614	1.980	.944	1.23
1920	105,711	69,085	36,477	65 44	1.494	1.508	1.482	1 01
1910	91,972	60,034	31,769	65.39	2.102	2 535	1.386	1 21
1900	75,995	47,891	27,903	63 19	2.135	2 340	1 798	1 10
1890	62,622	38,811	23,649	62 14	2.486	2.916	1 762	1 17
1880	50,156	30,049	20,107	59 91	3.008	3.197	2 738	1 06
1870	38,558	22,768	15,785	59 06	2 263	2 511	1.964	1 11
1860	31,443	18,198	13,194	57 97	3.558	3 787	3.222	1.06
1850	23,192	13,199	9,979	56.95				

* Estimated on basis of age schedule of mortality and fertility as of 1934.

† Estimated from births, deaths, and migration.

youngest age groups actually diminish; there is in consequence, a continual shifting in the proportion of the several age groups.

In the actual population of the United States, a similar shifting of the age groups has occurred, with certain important consequences. In

FIGURE 6
COMPARISON OF ANNUAL RATE OF INCREASE OF THE TOTAL POPULATION
AND POPULATION AGES 15 TO 69 IN THE UNITED STATES

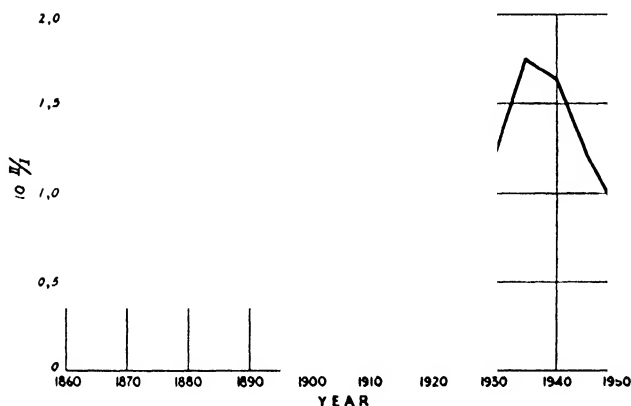
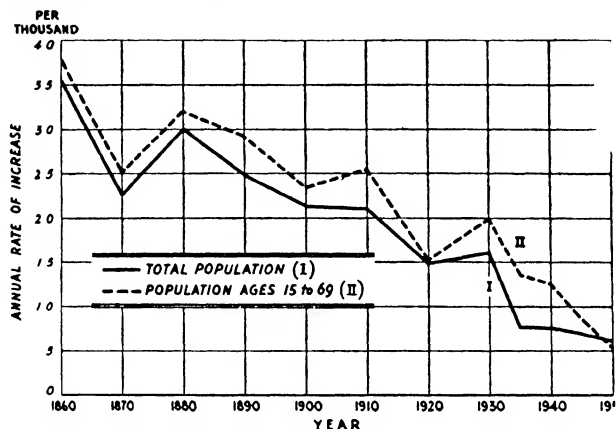


Table IV there have been set forth the per cent rates of increase for the total population of the United States, over the calendar period 1850 to 1930, extended to 1950 by estimates; and side by side with these figures the rates of increase of the population between the ages 15 and 69 have been shown. The last column gives the ratio of the increase in the population of ages 15 to 69 to the corresponding increase in the total population at successive decennial dates and in the last

three quinquennia. This table brings out a point which may be of very serious interest. Over the early decennia from 1850 to 1930, the ratio of the two rates of increase has not varied very greatly, the lowest value being 1.01 and the highest 1.23. But it will be noticed that from 1930 to 1935 there was a sudden increase in this ratio from 1.23 to 1.75. Here the rate of increase of the population between the ages 15 and 69 is almost twice as great as that of the total population, and judging from the forecast for 1940, that situation will continue essentially until that time. By 1945, this great disparity will again disappear. These facts are brought out graphically in Figure 6.

It is interesting to ponder what effect this situation may have on the opportunity for young persons to obtain gainful employment.

PHENOMENA EXHIBITED BY PARTICULAR UNITS OF THE POPULATION

Population analysis is concerned not only with the gross phenomena presented by the population regarded as a whole, but comprises within its scope also the consideration of specific phenomena exhibited by unit elements of which the population is composed. Without going to the extreme in this process of particularization, we shall here devote a few paragraphs to a certain aspect of family statistics.

If in a semi-logarithmic system of coordinates we represent the probability p_n or π , that a new-born child shall, in the course of its life, ultimately have n children or ν sons, a series of points is obtained, which, at any rate up to $n=10$, array themselves essentially in a straight line. In the graph Figure 7 thus constructed on the basis of the statistics of the United States (white persons) a curious circumstance becomes apparent; the probability of having two sons is equal to that of having two children. How does this singular result come about?

The probability of having n children, according to the linear distribution exhibited in Figure 7 is

$$(1) \quad p_n = 0.7358^{(n-1)} p_1$$

or, say

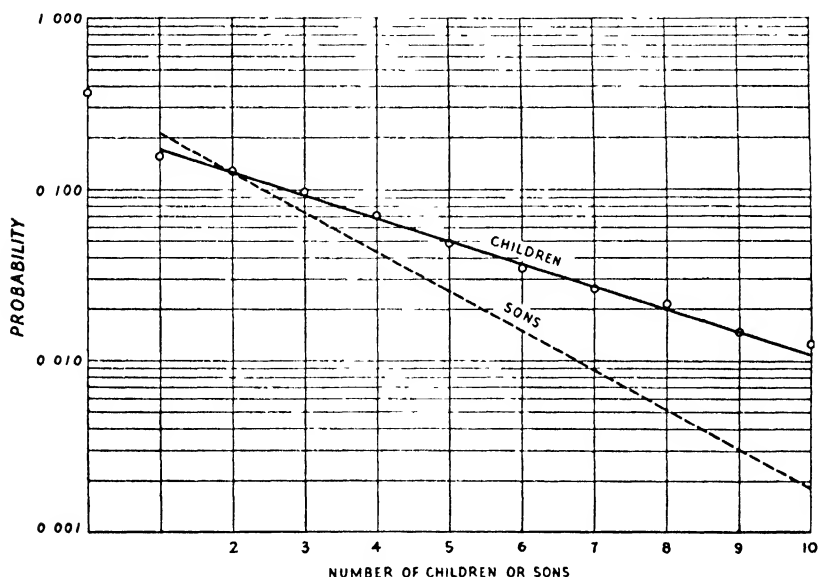
$$(2) \quad p_n = \gamma^{(n-1)} p_1 .$$

Let α be the proportion of male births and $\beta = (1 - \alpha)$ be the proportion of female births in the total. Then, by an application of elementary principles of the calculus of probability, we find for the probability π of having ν sons, the expression

$$\begin{aligned}
 (3) \quad & \pi_r = \Gamma^{r-1} \pi_1 \\
 (4) \quad & \Gamma = \frac{\alpha\gamma}{1 - \beta\gamma} \\
 & \quad \quad \quad 0.515 \\
 (5) \quad & \quad \quad \quad 1 - 0.485 \times 0.736 \\
 (6) \quad & \quad \quad \quad = 0.589 \\
 (7) \quad & \pi_1 = \alpha p_1 + 2\alpha\beta\gamma p_1 + 3\alpha\beta^2\gamma^2 p_1 + \dots \quad \alpha p_1 \\
 & \quad \quad \quad (1 - \beta\gamma)^2
 \end{aligned}$$

FIGURE 7

PROBABILITY FOR A NEW-BORN MALE OF EVENTUALLY HAVING A SPECIFIED NUMBER OF CHILDREN OR A SPECIFIED NUMBER OF SONS



Let us find the ratio

$$(8) \quad \pi_2/p_2 = \alpha^2/(1 - \beta\gamma)^3 = 0.2652/0.2660 = 0.9971 .$$

In round numbers this ratio is therefore 1. This arises from the fact that α and β are nearly equal, that is to say, the probability of a male or a female birth is in either case approximately one-half; on the other hand γ has a value of about three-quarters, so that according to formula (8) it follows that

$$(9) \quad \pi_2/p_2 = \frac{1}{4}/(1 - \frac{1}{2} \times \frac{3}{4})^3 = 1.024 .$$

We have here a statistical curiosity discovered accidentally by the

author in dealing with the problem of the probability of extinction of a family.⁹

THE IDEAL AIM OF RATIONAL POPULATION ANALYSIS

The particularization of the discussion could be carried further. From the consideration of the family as a social unit we could proceed to that of the individual himself. The ideal would be a model which, by its operation, would represent the actions and destinies of the individuals of a typical population. Such a model might consist of a collection of urns which, by a series of drafts conducted according to prescribed rules, would give us a truly representative sample of the characteristics of the population. This ideal, though incapable of realization in all detail, can be approached to within a degree of accuracy which will depend on the one hand on our sources of statistical data and on the other on the pains which we are willing to take in carrying out the task.

Such a model has been actually constructed on the basis of vital statistics of the United States, using, however, in place of inconvenient urns, an equivalent device, a kind of roulette wheel, with discs divided by radial lines into sectors of suitably adjusted angle. Unfortunately it is not possible on a scale suitable for these pages to reproduce the series of discs employed in this model.

⁹ A. J. Lotka, "The Extinction of Families," *Journal of the Washington Academy of Sciences*, Vol. 21 (1931), pp 377, 453

PROCEEDINGS
NINETY-NINTH ANNUAL MEETING

HADDON HALL, ATLANTIC CITY

PROGRAM

Monday, December 27, 1937

—2:30 P.M.—

THE THEORY AND APPLICATIONS OF THE CHI-SQUARE TEST

Chairman: Burton H. Camp, Wesleyan University

Theory of the Chi-Square Test

Thornton C. Fry, Bell Telephone Laboratories

Some Thoughts on Curve Fitting and Extrapolation

W. Edwards Deming, U. S. Department of Agriculture

Difficulties of Interpretation Encountered in the Application of the Chi-Square Test

Joseph Berkson, Mayo Clinic

CHANGING TRENDS IN FINANCING OF AMERICAN BUSINESS

Chairman: Leonard P. Ayres, The Cleveland Trust Company

The Function of Deposit Banking

E. A. Goldenweiser, Board of Governors of the Federal Reserve System

Tendencies in Consumer Financing

Rolf Nugent, Russell Sage Foundation

Changes in Capital Financing

Donald B. Woodward, Moody's Investors Service

FAMILY INCOMES

(With the Conference on National Income and Wealth)

Chairman: Simon Kuznets, National Bureau of Economic Research

Changes in the Distribution of Family Incomes Between 1929 and 1933

David L. Wickens, National Bureau of Economic Research

Distribution by Income and Sources of Incomes of Families of Different Sizes and Composition

Bernard Barton, Bureau of Labor Statistics

—7:00 P.M.—

DINNER MEETING FOR FELLOWS AND REGULAR MEMBERS OF THE AMERICAN STATISTICAL ASSOCIATION TO CONSIDER THE OBJECTIVES AND PROGRAM OF THE ASSOCIATION

Chairman: W. Randolph Burgess, President

Report of the Board of Directors

Announcement of the Election of Fellows

Discussion of the Plans and Progress of the Association

Tuesday, December 28, 1937

—10:00 A.M.—

THE THEORY AND APPLICATIONS OF FIDUCIAL PROBABILITY

Chairman: Walter A. Shewhart, Bell Telephone Laboratories

Introduction to Fiducial Probability

Edward V. Huntington, Harvard University

Fiducial Distributions

S. S. Wilks, Princeton University

Discussion: George W. Snedecor, Iowa State College

PUBLIC OPINION AND PUBLIC RELATIONS

Chairman: Donald R. Belcher, American Telephone and Telegraph Company

Quantitative Methods in Politics

Stuart A. Rice, Central Statistical Board

Government and the Sampling Referendum

George Gallup, American Institute of Public Opinion

Public Opinion and Public Relations

Edward L. Bernays, Counsel on Public Relations

FUNCTION OF DEPOSIT BANKING

Chairman: John H. Williams, Federal Reserve Bank of New York

Trends of Principal Earning Assets and Their Significance

William J. Carson, University of Pennsylvania

Distribution of Bank Deposits

Lauchlin Currie, Board of Governors of the Federal Reserve System

Trends of Bank Earnings and Expenses

Donald S. Thompson, Federal Deposit Insurance Corporation

Uses of Statistics in Bank Administration and Supervision

Homer Jones, Federal Deposit Insurance Corporation

TENDENCIES IN CONSUMER FINANCING

Chairman: Wilbur C. Plummer, University of Pennsylvania

Consumer Financing and Its Relations to the Commercial Bank

David C. Barry, Lincoln-Alliance Bank and Trust Company

The Economic Function of the Sales Finance Company

Milan V. Ayres, National Association of Sales Finance Companies

Public Supervision of Consumer Credit

William T. Foster, Pollak Foundation for Economic Research

—12:00 NOON—

COMMITTEE ON SOCIOMETRICS

(Luncheon Meeting with Section on Sociology and Psychiatry, American Sociological Society)

Chairman: George A. Lundberg, Bennington College

Speaker: J. L. Moreno, Beacon Hill Hospital

Tuesday, December 28, 1937

—12:30 P.M.—

LUNCHEON MEETING, COMMITTEE ON CENSUS ENUMERATION AREAS

Chairman: Howard Whipple Green, Cleveland Health Council

Extension of Census Tracts to Suburban Areas of Metropolitan Cities

Clarence E. Batschelet, Bureau of the Census

—2:30 P.M.—

MARKET PRICE AND COST ANALYSIS

(With the American Marketing Association)

Chairman: Vergil D. Reed, Bureau of the Census

Varying Functions in Distribution: Their Costs and Influence on Prices

John F. Thomas, Sears, Roebuck and Company

The Effects of Cost Analysis on Prices

W. H. S. Stevens, Interstate Commerce Commission

Differential Selling Costs in Relation to Wholesale Prices

Donald R. G. Cowan, Swift and Company

BIOMETRICS

Chairman: E. B. Wilson, Harvard University

Some Problems Arising in Analysis of Compound Frequency Distributions

Robert A. Nesbit, Harvard Biological Laboratories

Discrete Frequency Distributions Arising from Mixtures of Several Single Probability Values

H. Muench, The Rockefeller Foundation

Biological Applications of Normal Range and Significance Estimates in Ignorance of Original Distribution Forms

William R. Thompson, New York State Department of Health

Sampling a Marine Fish Population: Some Problems and Results

William C. Herrington, Harvard Biological Laboratories

A Secondary Sampling Problem in Human Biology

E. Morton Jellinek, Worcester State Hospital

EMPLOYMENT AND UNEMPLOYMENT STATISTICS

Chairman: Faith M. Williams, Bureau of Labor Statistics

Some Measures of Changing Labor Productivity and their Uses of Economic Analysis

David Weintraub, National Research Project

Measuring Unemployment as Status or Behavior

Calvert L. Dedrick, National Unemployment Census

The Federal-State Cooperative Program for Employment and Payroll Statistics

Sidney Wilcox, Bureau of Labor Statistics

CHANGES IN CAPITAL FINANCING

Chairman: Ralph A. Young, University of Pennsylvania

Changes in the Secondary Distribution of Equities

Harry J. Loman, University of Pennsylvania

Changed Conditions in the Marketing of New Issues

Jules I. Bogen, Journal of Commerce

Changes in Real Estate Financing

David L. Wickens, National Bureau of Economic Research

Tuesday, December 28, 1937

—3:00 P.M.—

SOME STATISTICAL METHODS

(With the American Sociological Society)

Chairman: Thomas C. McCormick, University of Wisconsin

A Study of the Relationships between Juvenile Delinquency and Other Indices of Social Disorganization

Jerry A. Neprash, Franklin and Marshall College

Adequacy of State Care of Mental Patients

Ellen Winston, Works Progress Administration

The Analysis and Treatment of Partial Information Schedules and Refusals in Social Surveys

Mildred Parten, Bureau of Labor Statistics

Fitness for Parenthood

J. Yerushalmy, New York State Department of Health

Discussion: Leonard S. Cottrell, Jr., Cornell University

Robert E. L. Faris, Brown University

A. R. Mangus, Works Progress Administration

—8:00 P.M.—

PRESIDENTIAL ADDRESSES

(With the American Economic Association)

Chairman: Davis R. Dewey, Massachusetts Institute of Technology

Oliver M. W. Sprague, American Economic Association

W. Randolph Burgess, American Statistical Association

Wednesday, December 29, 1937

—9:30 A.M.—

MEASUREMENT OF MARKETS AND OF ADEQUACY OF MARKETING METHODS

(With the American Marketing Association)

Chairman: Lyndon O. Brown, Northwestern University

Getting Significant Facts from Market Data

Theodore H. Brown, Harvard University

Determining the Significance of Sampling Necessary in Studies of Retail Trade

J. Parker Bursk, University of Pennsylvania

Analyzing the Radio Market

John J. Karol, Columbia Broadcasting System

The Problem of Measuring Radio Coverage

L. D. H. Weld, McCann-Erickson, Incorporated

Wednesday, December 29, 1937

—10:00 A.M.—

STATISTICS RELATED TO SOCIAL SECURITY

Chairman: Samuel A. Stouffer, University of Chicago

Some Possibilities of Utilizing Social Security Data for Sociological Research Projects

Dorothy S. Thomas, Institute of Human Relations, Yale University
Economic Data Available from Social Security Sources

Eleanor L. Dulles, Social Security Board

Discussion: Ewan Clague, Social Security Board

THE INFLUENCE OF VARIOUS FACTORS UPON FLUCTUATIONS OF INVESTMENT
(With the American Economic Association)

Chairman: Sumner H. Slichter, Harvard University

The Rate of Interest

Richard M. Bissell, Jr., Yale University

Security Markets and the Investment Process

Kemper Simpson, Formerly with the Securities and Exchange Commission
Corporate Price Policies

Corwin D. Edwards, Federal Trade Commission

BIOMETRICS

Chairman: Lowell J. Reed, The Johns Hopkins University

Actuarial Studies of Dental Caries

Carroll Palmer and Henry Klein, U. S. Public Health Service
Comparability of Mortality Statistics

Theodore A. Janssen and Halbert L. Dunn, Bureau of the Census
Defects in Present Information on Differential Reproduction

Frank Lorimer, Population Association of America

—12:30 P.M.—

LUNCHEON MEETING. STATISTICS IN RELIEF ADMINISTRATION

(Arranged by the Joint Committee on Relief Statistics, American Public Welfare Association and American Statistical Association)

Chairman: Paul Webbink, Committee on Social Security, Social Science Research Council

Consolidated Statistics of Relief Expenditures Since 1933

Dorothy Fahs Beck, Central Statistical Board

Incidence of Emergency Dependency in New York State During the Depression

Edward T. Frankel, New York State Department of Social Welfare

Discussion: Herman M. Somers, Wisconsin State Department of Welfare

Wednesday, December 29, 1937

—2:30 P.M.—

ROUND TABLE SESSIONS ON FLUCTUATIONS IN INVESTMENT
(With the American Economic Association)

1. GENERAL INTEREST THEORY

Chairman: Bernard F. Haley, Stanford University

Discussion: Paul T. Ellsworth, University of Cincinnati
Arthur W. Marget, University of Minnesota
Max F. Millikan, Yale University
Walter A. Morton, University of Wisconsin

2. RATE OF INTEREST

Chairman: Winfield W. Riefler, Institute for Advanced Study

Discussion: John B. Canning, Stanford University
J. Franklin Ebersole, Harvard University
Harry White, Department of the Treasury
Fred R. Macaulay, National Bureau of Economic Research

3. SECURITY REGULATION

Chairman: Ray B. Westerfield, Yale University

Discussion: Karl R. Bopp, University of Missouri
Fritz Machlup, University of Buffalo
Raimund W. Goldschmidt, Securities and Exchange Commission
Carl E. Parry, Board of Governors of the Federal Reserve System
Alexander Sachs, Lehman Brothers
John E. McDonough, Securities and Exchange Commission
Fritz Lehmann, New School for Social Research
James C. Dolly, University of Texas

4. CORPORATE PRICE POLICIES

Chairman: Frederick B. Garver, University of Minnesota

Discussion: Gustav Seidler, National Resources Committee
Lloyd G. Reynolds, Harvard University
Frank M. Boddy, University of Minnesota
Rufus S. Tucker, General Motors Corporation

5. CAPITAL GAINS AND LOSSES, THEIR TREATMENT IN INCOME MEASUREMENT AND IN INCOME TAXATION

Chairman: George O. May, Price, Waterhouse & Co.

Discussion: Roy Blough, University of Cincinnati
William Hewett, University of Cincinnati
Robert M. Haig, Columbia University
Harold M. Groves, University of Wisconsin
Henry C. Simons, University of Chicago

Wednesday, December 29, 1937

—2:30 P.M.—

REPRESENTATIVENESS AND BIASES OF SURVEY DATA AND INDEX NUMBERS

Chairman: J. Frederic Dewhurst, The Twentieth Century Fund

Bias in Studies of Family Income and Methods of Compensating for It

A. D. H. Kaplan, Bureau of Labor Statistics

Representativeness of Market Surveys

Paul T. Cherington, Market Research Corporation of America

Statistical Bias in Primary Data and Public Policy

A. F. Hinrichs, Bureau of Labor Statistics

SOCIAL SECURITY

(With the American Association for Labor Legislation)

Chairman: Edwin E. Witte, University of Wisconsin

European and American Social Security Parallels

C. A. Kulp, University of Pennsylvania

Financing of Social Security Costs, Particularly by the States

Wilbur Cohen, Social Security Board

Medical Costs in California

Paul A. Dodd, University of California

Discussion: J. Douglas Brown, Princeton University

Clarence Heer, University of North Carolina

Michael M. Davis, Committee on Research in Medical Economics

BIOMETRICS

Chairman. Joseph Berkson, Mayo Clinic

Relation of Birth Order to Insanity

Benjamin Malzberg, New York State Department of Mental Hygiene

Residual Relationships and Velocity of Change as Pitfalls in the Field of Statistical Forecasting

Leon E. Truesdell, Bureau of the Census

A Short Method of Life Table Construction

Margaret Merrell, The Johns Hopkins University

The Methodological Considerations in Comparison of Rates for Geographic Areas

Samuel A. Stouffer, University of Chicago

—5:00 P.M.—

SECOND SESSION OF THE ANNUAL BUSINESS MEETING

Election of Officers

—6:30 P.M.—

BUSINESS PROSPECTS

Chairman: W. Randolph Burgess, President, American Statistical Association

Speakers: Lionel D. Edie, Capital Research Company

Leonard P. Ayres, The Cleveland Trust Company

Thursday, December 30, 1937

—10:00 A.M.—

THE INFLUENCE OF VARIOUS FACTORS UPON FLUCTUATIONS OF INVESTMENT
(With the American Economic Association)

Chairman: Joseph S. Davis, Stanford University

Fiscal Policies

Arthur D. Gayer, Columbia University

Rate of Consumption

Albert G. Hart, University of Chicago

Wage Rates

Leo Wolman, Columbia University

RESEARCH PAPERS IN MATHEMATICAL STATISTICS

Chairman: Robert W. Burgess, Western Electric Company

On Certain Limiting Distributions and Asymptotic Expansions in Statistical Theory

William G. Madow, Milbank Management Corporation

The Limiting Distribution of Canonical Correlations and Related Topics

Meyer A. Girshick, Columbia University

—10:30 A.M.—

MONETARY POLICIES AND AGRICULTURE

(With the American Farm Economic Association)

Chairman: M. S. Szymczak, Board of Governors of the Federal Reserve System

Present Federal Reserve Policies

Melchior Palyi, University of Chicago

Inflation and the Farmer

Louis H. Bean, Agricultural Adjustment Administration

Discussion: Arthur R. Upgren, University of Minnesota

Fred L. Garlock, Bureau of Agricultural Economics

—1:00 P.M.—

HOW TO STUDY THE SOCIAL ASPECTS OF THE DEPRESSION

(With the American Sociological Society)

Chairman: Wesley C. Mitchell, Columbia University

Discussion led by Edwin B. Wilson, Harvard University

—2:30 P.M.—

INTERPRETATION OF STATISTICAL DATA ON FAMILY EXPENDITURES

Chairman: Clark Warburton, Federal Deposit Insurance Corporation

The Regression Analysis of Family Expenditure Data

Milton Friedman, National Bureau of Economic Research

Variations in Family Living Expenditures

Dorothy Brady, Bureau of Home Economics

Expenditure Patterns of Urban Families of Different Income Levels

Mildred Parten and A. C. Rosander, Bureau of Labor Statistics

Thursday, December 30, 1937

—2:30 P.M.—

ROUND TABLE SESSIONS ON FLUCTUATIONS IN INVESTMENT

(With the American Economic Association)

1. FISCAL POLICIES

Chairman: Robert M. Haig, Columbia University

Discussion: Alfred G. Buehler, University of Vermont
Arthur R. Upgren, University of Minnesota
Carl Shoup, Columbia University
Melchior Palyi, University of Chicago

2. SOCIAL SECURITY PROGRAM

(With the American Association for Labor Legislation)

Chairman: William A. Berridge, Metropolitan Life Insurance Company

Discussion: Harold V. Roelse, Federal Reserve Bank of New York
Otto Nathan, New York University
Eleanor L. Dulles, Social Security Board
Edison L. Bowers, Ohio State University

3. RATE OF CONSUMPTION

Chairman: Simon Kuznets, National Bureau of Economic Research

Discussion: Herbert D. Simpson, Northwestern University
George Halm, Tufts College
Walter Egle, Ohio State University
H. L. McCracken, Louisiana State University

4. DURABLE CONSUMERS' GOODS

(With the American Marketing Association)

Chairman: Calvin Hoover, Duke University

Discussion: Albert Haring, Lehigh University
Norman J. Silberling, Stanford University
G. Coleman Woodbury, National Association of Housing Officials
F. Leslie Hayford, General Motors Corporation

5. WAGE POLICIES

(With the American Association for Labor Legislation)

Chairman: Frank D. Graham, Princeton University

Discussion: Paul Sweezy, Harvard University
Carroll R. Daughtery, University of Pittsburgh
Lorie Tarshis, Tufts College

6. PRICE CHANGES AND NATIONAL INCOME

Chairman: Morris A. Copeland, Central Statistical Board

Discussion: Gottfried Haberler, Harvard University
Hans Neisser, University of Pennsylvania
Lauchlin Currie, Board of Governors of the Federal Reserve System
Charles O. Hardy, Brookings Institution

Minutes of the Annual Business Meeting

The American Statistical Association convened for the ninety-ninth annual business meeting at 8:20 p.m., Monday, December 27, 1937, at Had-don Hall in Atlantic City. President W. Randolph Burgess presided.

The minutes of the ninety-eighth annual business meeting were approved as published in the JOURNAL.

The amendments to the Constitution which had been approved at the ninety-eighth annual business meeting were adopted.

It was voted to amend By-Law 4 to make it read as follows:

4. There shall be eight Vice-Presidents. The field or fields of interest to be represented by each Vice-President shall be specified by the Board of Directors. The Nominating Committee shall make a nomination for each field of interest except that with the approval of the Board of Directors the Committee may nominate a smaller number of Vice-Presidents by assigning to some of them responsibility for representing more than one field of interest.

E. A. Goldenweiser read the report of the Committee on Fellows and announced that the following members had been elected as Fellows: Robert W. Burgess, Harold Hotelling, Aryness Joy, Simon Kuznets, O. C. Stine and Leon E. Truesdell.

The report of the Nominating Committee was read by E. B. Wilson.

The Secretary read the Annual Report of the Board of Directors.

Stuart A. Rice spoke briefly on the development of plans for celebrating the centenary of the Association in the fall of 1939.

Walter F. Willcox spoke on the meeting of the International Statistical Institute in the United States in 1939.

The agenda of the annual business meeting was arranged to leave considerable time for a general discussion of the Association's plans and progress. Quite a number of officers and members participated. One member expressed his belief that the JOURNAL should be devoted less to methodology and more to the practical problems with which statisticians are struggling. He thought the *Bulletin* would be very valuable if it reported statistical projects under way in state bureaus and other organizations. Another member communicated his desire to have greater emphasis in the Association's meetings and publications on practical problems and on the meaning of statistical interpretations rather than on the figures by themselves. It was suggested that the Association seek to develop an adequate scheme of classification of statistical materials for special libraries. A project was proposed to determine what a statistician is, how many statisticians there are, and what opportunities there may be for college students who wish to enter statistical occupations.

The Association was urged to give attention to glaring instances of error and misinterpretation in the use of statistics which may be found even in publications of organizations of the highest reputation. Review and critical examination of statistical work was suggested by several members as a very important function that the Association should perform. A plan of committee

procedure which might prove most effective in performing this function was proposed.

Officers and members were reminded that special efforts were needed to maintain the budget and program of the Association at their present level as the Rockefeller Foundation grant diminishes each year toward its termination in 1940. It was noted that the diversified membership of the Association was both a weakness and strength; that in bringing together statisticians from the universities, from business, and from government, the Association has a great opportunity to overcome the departmentalizing of scientific knowledge and research. A more extensive summary of the discussion is to be published in the *Bulletin*.

The meeting was adjourned to 5:00 P.M., December 29, 1937.

The annual business meeting was resumed at 5:00 P.M., Wednesday, December 29, 1937. The Secretary reported that he had received no nominations by petition. It was voted to instruct the Secretary to cast one ballot for the nominees presented by the Committee on Nominations. The ballot was cast and the following officers and directors were elected:

President R. H. COATS

Vice-Presidents

Collection and Classification of Data, and Administration of Statistical Agencies

ISADOR LUBIN

Statistical and Actuarial Methods and Technique, and the Teaching of Statistics

BURTON H. CAMP

Facts and Methods Pertaining to Sociology, Social Welfare Problems, and Labor Statistics

SAMUEL A. STOFFER

Facts and Methods Related to Biometry, Vital Statistics, Psychology, and Education

HALBERT L. DUNN

Facts and Methods Bearing upon Economics and Economic Theory

RALPH C. EPSTEIN

Facts and Methods Pertaining Primarily to Business

THEODORE H. BROWN

Facts and Methods Pertaining to Financial Institutions

CHARLES O. HARDY

Facts and Methods Pertaining to Marketing

DAVID R. CRAIG

Directors (For terms expiring at the close of the Annual Meeting in 1940)

W. RANDOLPH BURGESS

GEORGE O. MAY

Secretary-Treasurer FREDERICK F. STEPHAN

The following resolutions were adopted:

RESOLVED, that the members of the American Statistical Association express to W. Randolph Burgess their great appreciation of his leadership as President during 1937 and extend congratulations and thanks to him and to Vice-Presidents Faith M. Williams, Burton H. Camp, Samuel A. Stouffer, Halbert L. Dunn, Alvin H. Hansen, Donald R. Belcher, Casimir A. Sienkiewicz, and John H. Cover for arranging the very fine program of this Annual Meeting.

RESOLVED, that the American Statistical Association expresses its gratitude and appreciation to J. Frank Reh fuss, representative on the Joint Committee on Local Arrangements and to Howard T. Hovde, Chairman of that Committee, for their painstaking work in making the local arrangements essential to the success of this Annual Meeting.

RESOLVED, that the American Statistical Association warmly thanks the management and employees of the Chalfonte-Haddon Hall for the fine hospitality which the members of the Association have enjoyed.

RESOLVED, that the American Statistical Association warmly thanks the management and employees of the Traymore Hotel for the fine hospitality extended to the Association for two of the principal sessions of this Annual Meeting.

The meeting was adjourned.

FREDERICK F. STEPHAN, *Secretary*

Report of the Board of Directors

Nineteen hundred and thirty-seven has been a year of accomplishment and continued growth. Although many of our objectives are yet to be reached, we have made substantial progress and can look back on the year with a sense of satisfaction. With the continued cooperation of the officers, Fellows, and regular members of the Association during the year which is about to begin, we may hope to report further advances when we meet again a year hence.

We may pause to review at this time the meetings that we have held during the year, the activities of our chapters and committees, our publications, the growth of our membership, our financial situation, and our program of objectives.

Meetings: During the course of the year the President and Vice-Presidents, with the advice and assistance of the Secretary and many members of the Association, have prepared an extensive program for this, the Ninety-ninth Annual Meeting. To a greater extent than in previous years, we are sharing the sponsorship of some of the sessions with our kindred associations. Twenty-three of the 41 sessions are joint sessions. A principal part of the program is the series of sessions arranged by the American Economic Association

and the American Statistical Association beginning with the presidential addresses and continuing with two general sessions and eleven round tables. The central theme of this series is "The Influence of Various Factors Upon Fluctuations in Investment." For other fields of interest, sessions have been arranged by each of the Vice-Presidents and by three of the Association's committees. It has not been possible to include in the program all of the subjects which have been suggested or to avoid entirely the scheduling of sessions at the same time as other sessions devoted to closely related subjects, but a wide range of significant statistical subjects will be presented by the speakers and there will be many opportunities for fruitful discussion.

A special meeting of the Association was held in Denver last June in connection with the summer meetings of the American Association for the Advancement of Science. The Econometric Society and the American Sociological Society joined with us in sponsoring some of the sessions.

The Committee on Biometrics joined with the Committee on Vital Statistics of the American Public Health Association in sponsoring a meeting in October in New York City. The Committee on Labor Statistics conducted a Conference on Occupational Classification in Philadelphia in April. The Association's committees in the field of social welfare met together in Indianapolis during the National Conference of Social Work in May. In September a small group of business statisticians met for a full day's meeting on invitation from our Vice-President for business statistics. These meetings and the regular meetings of the Association's committees have provided opportunities for the discussion of statistical problems and for conference between members interested in special subjects.

Chapters: The chapters of the Association have had a rich program of meetings during the year, reports of which are published in the JOURNAL. During the year the charter of the Los Angeles Chapter, which had become inactive, was revoked and new chapters in Cincinnati and the Lehigh Valley were chartered. As a result of a conference with representatives from the chapters held at the last annual meeting, the Directors have revised the regulations pertaining to chapters with the hope that the new regulations may be beneficial both to the chapters and to the Association.

Committees: The Association has a number of committees concerned with specific fields of statistical data and analysis. Reports of their work are published each year in the March issue of the JOURNAL. The Committee on Committee Organization and Activities (formerly the Committee to Stimulate and Coordinate Research) consists principally of the chairmen of these committees and is appointed to review the fields in which the Association has or might have committees at work, to advise the Board of Directors with respect to the appointment of committees, and to facilitate cooperation between committees working on related problems. This Committee has met twice during the year and has functioned as a conference on the Association's committee work.

At the beginning of the year, after discussion and with mutual agreement, the American Economic Association withdrew from participation in the

appointment of the Advisory Committee on the Census in order to simplify the organization of the Committee and facilitate the appointment of a membership more widely representative of the fields in which the Census Bureau operates. In performing its function of advising the Director of the Census, the Committee met in Washington in April and again in October.

The Committee on Census Enumeration Areas met in July to discuss certain census tract problems presented by the Central Statistical Board and the Works Progress Administration. Through correspondence and a conference of representatives of census tract cities at the time of the Association's annual meetings each year, the Committee is extending the use of census tract data and developing definite recommendations with respect to the data which should be tabulated.

The Committee on Statistics of Delinquents and Criminals has continued its contact with the collection of criminal judicial statistics by the Census Bureau and with the needs expressed by several states for a handbook of procedure for the compilation of these statistics.

The Joint Committee on Income Tax Statistics did not meet during the year, but its Chairman conferred with representatives of the Treasury Department concerning changes in the tabulation of corporation income data. Further conferences involving the full Committee are planned for the coming year.

The principal activity of the Committee on Labor Statistics this year was the organization of the Conference on Occupational Classification mentioned previously. An informal meeting with the Advisory Committee on the Census has been planned for an early date in January.

The Committee on Statistics of Institutions for Mental and Physical Disorders met twice during the year, maintaining contact with committees of other organizations which are working toward the same statistical objectives. The Committee is giving considerable attention to the development of a simplified manual for the collection of hospital statistics and has proposed a registration area for social welfare statistics.

The Joint Committee on Relief Statistics has met six times during the year and has planned a seventh meeting during this annual meeting period. It has served as an advisory committee to the Division of Public Assistance Statistics of the Social Security Board and has also advised several other agencies informally in response to special requests. The Committee held conferences of relief statisticians at the time of the meetings of the National Conference of Social Work and the American Public Welfare Association. Its Bulletin of Information for Relief Statisticians has been issued three times this year.

The Committee on Statistics of Dependent Children in Foster Care, having completed a major project, is exploring its further opportunities for useful work in this field.

The Committee on an Annual Review of Progress in Mathematical Statistics met early in the year and outlined a plan for reviews of individual topics, one or two of which would be presented each year. These reviews

are planned to cover the development of the topic during a period of years and to include a discussion of the underlying theory and the practical applications of each method. Some of the topics are to be discussed at meetings, then prepared for publication. In accordance with this plan, sessions on the chi-square test and on fiducial probability have been arranged as part of the program for this Annual Meeting.

The Committee on Biometrics joined with the Vital Statistics Section of the American Public Health Association in holding a meeting in October in New York City. In cooperation with the Vice-President responsible for this field, the Secretary of the Committee arranged three sessions of scientific papers for this Annual Meeting.

The Committee on Sociometrics has planned a luncheon meeting with the Section on Sociology and Psychiatry of the American Sociological Society at this Annual Meeting.

Through its representatives, the Association participated in the work of the Social Science Research Council, the National Bureau of Economic Research, the American Association for the Advancement of Science, the Business Research Council, the National Conference on the Nomenclature of Disease, the Joint Committee for the Development of Statistical Applications in Engineering and Manufacturing, the Sectional Committee on Standards for Graphic Presentation, the Conference on National Income and Wealth, and the New York Management Council.

The Association does not have funds with which its committees can undertake extensive investigations or research work. In a few instances in the past, Association committees have received special grants from other sources to enable them to undertake major projects. Except in these instances, the principal function of the committees is to provide an opportunity for conferences between members of the Association who are actively interested in the problems of a definite field of statistical data. In the meetings of the Association's committees, members find an opportunity to confer with each other as individual statisticians rather than as official representatives of government agencies and private organizations. Consequently, they can concentrate their attention on the scientific aspects of their problems. One of the principal results of such conferences is the improvement of the procedures by which statistical data are collected and thereby the improvement of the data themselves.

Publications: The JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION completed its fiftieth year with the publication of the December issue. This year's volume has been similar in size and contents to the volumes immediately preceding it. The subjects treated in the articles have been principally those for which outstanding manuscripts were submitted, but, in selecting manuscripts for publication, an effort was made to achieve a better balance of material in relation to the interest of the members of the Association. In some subjects there was a dearth of suitable manuscripts but in most subjects there were many more manuscripts than could be published in the JOURNAL. The Editor was assisted in the selection of papers by a number of

editorial advisers whose recommendations were a highly important part of the editorial work.

Approximately one-fifth of this year's volume was devoted to reviews of books on statistical subjects. Many members report that they find this part of the JOURNAL of greatest interest. The book-review section of the JOURNAL is entirely under the direction of the Review Editor. The JOURNAL continues to carry news and notes concerning the activities of various statistical agencies and reports of the meetings of the Association's chapters.

Three issues of the Association's bulletin were sent to members during the year, carrying announcements of meetings, news about members, letters from members on several statistical problems, and the preliminary program of the annual meeting. There have been many expressions of interest in the bulletin and it appears to have demonstrated its value. In the future it may be published more frequently as some members have suggested. There is reason to believe that it will become increasingly valuable as the officers, committees, and members of the Association find opportunities to use it in presenting informal communications to the membership of the Association.

Membership: The membership of the Association increased during 1937 from 1,875 to 2,044 members. Four members became Life Members during the year bringing the number of Life Members to 34, and three members became Contributing Members. The membership of the Association is still smaller than it was in 1930 when there were 2,267 members. In response to a letter from the President last January, a number of members nominated persons of their acquaintance who were interested in statistics and other members submitted nominations throughout the year. The increase in membership is largely due to the response of these members.

Central Office: Early in the year the Board of Directors reviewed their original decision to locate the office of the Association in Washington and decided to continue the present location until at least July 1, 1938. An attempt has been made throughout the year to maintain close contact between the Association's headquarters and its membership in other cities than Washington, through visits by the Secretary and correspondence.

Finances: During the year the Association received \$6,000 from The Rockefeller Foundation in connection with the special grant made in 1935 to enable the Association to strengthen its headquarters organization, to maintain contact with government statistics, and to develop its committee work. With this very substantial and welcome assistance in the Association's work, we are closing the year with an excess of receipts over expenditures. The Rockefeller Foundation grant continues through 1940 in amounts which diminish at the rate of \$1,500 each year. The Board of Directors seeks the assistance of the Fellows and regular members of the Association in increasing the Association's income from dues, advertising, and special gifts, so that we may maintain our present activities and continue to progress.

Board of Directors: The Directors of the Association have given their time and attention to many phases of the Association's activities. They met five times during the year to consider the numerous items of business which come before the governing body of an active association, to review our progress, and to plan for the future. As an aid to continuity in the Board's administration of the Association's affairs and a guide to the officers, the Directors have prepared during the last two years an extensive memorandum outlining the policies and principles by which the Association has been guided in the past. Almost every phase of the Association's activities has been reviewed by the Board of Directors and numerous improvements have resulted. The Directors have consulted the other officers on many matters and have sought to establish closer contacts with the Fellows and regular members of the Association.

Objectives: In their discussions during the year the Directors have recognized a number of objectives. The fundamental purpose of the Association is the advancement of statistics, both as a scientific technique and as a body of data systematically compiled. Our activities are designed to accomplish this basic purpose by providing to members many opportunities for the discussion of statistical subjects and for cooperation in the pursuit of their scientific aims. We also seek to accomplish our fundamental purpose of advancing statistical science by cooperating with other associations through joint committees, joint meetings, and otherwise, and by cooperating with government statistical agencies through formal and informal advisory relationships.

There are many aspects of our fundamental objective which would be included in any detailed outline of what it involves. It includes the development of better methods and better data by providing facilities for the publication of new developments and the discussion of problems, by providing opportunities for conferences and constructive criticism, and by the encouragement of research. It includes the dissemination of knowledge concerning statistical information and technique in a way that supplements and benefits formal instruction in statistics in our universities and colleges. Such an outline would include promoting wider recognition of the standards and characteristics of good statistical work. It would also include a clearer conception of the duties and functions of the professional statistician and the part that he should play in management and in research. Several other detailed purposes might be listed, including the interest that every scientific organization has in promoting wise and proper applications of the science in many fields of human activity.

In order that we may realize our fundamental purposes we must plan the next steps and outline our more immediate objectives. We seek to improve our activities wherever they may be improved. We seek an increasingly active participation of the Fellows and Regular Members of the Association in these activities as officers, as committee members, as speakers, as contributors to the JOURNAL and to the Association's bulletin, and as active

members of the Association assisting in various ways. The immediate objectives through which we can accomplish this can be summarized in a brief outline:

1. *Organizational improvements.* The establishing of Chapters has improved our organization and provided opportunities for members to meet. We are now providing for the organization of sections, for those fields of statistical interest in which sectional organization will be advantageous.

2. *The Association office.* By arranging to have the Secretary-Treasurer devote his full time to the work of the Association, including editing of the JOURNAL, and by the development of the Association office, it has been possible to provide greater assistance to the officers and committees of the Association in their work. This has facilitated most of the Association's activities.

3. *The development of the bulletin.* The bulletin which has been issued three times a year during the last two years is becoming a very useful means of communication to keep the membership of the Association in touch with many of our activities and to bring before the Association communications from members on important subjects.

4. *Conferences and committee work.* We seek continued progress in the work of our committees and the further development of conferences on special subjects.

5. *A stronger financial basis.* We need to increase our income in order that we may continue to maintain the activities now being financed in part through The Rockefeller Foundation grant and in order that we may make further improvements in these activities. The maintaining of the Association office, the development of the bulletin, the committee work, the travel expenses of officers in connection with Association business and in visiting chapters, and other important phases of our activities depend upon the realization of this objective. Our principal opportunities to increase our income lie in the expansion of our membership, increasing our subscription and advertising income, and securing contributing members. We may also hope that from time to time the Association will receive special gifts and contributions for its general program.

6. *An active, interested membership.* While an adequate financial basis is essential it is matched by the expenditure of time and effort without compensation on the part of many members of the Association. The activities of the Association cannot be carried on without this great voluntary contribution to what we are engaged in doing. The Association is deeply indebted to the officers and other members who have devoted so much of their time to its affairs and it goes forward into 1938 with the hope that these members will find in the Association's achievements values which justify the efforts which they have expended in its behalf.

W. RANDOLPH BURGESS

MORRIS A. COPELAND

JOSEPH S. DAVIS

WILLFORD I. KING

FREDERICK C. MILLS

HENRY L. RIETZ

FRANK A. ROSS

FREDERICK F. STEPHAN

Report of the Committee on Fellows

The Committee on Fellows has elected by unanimous vote the following Fellows: Robert W. Burgess, Harold Hotelling, Aryness Joy, Simon Kuznets, O. C. Stine, and Leon E. Truesdell.

WILLIAM F. OGBURN
EMANUEL A. GOLDENWEISER
E. DANA DURAND
WALTER A. SHEWHART
F. LESLIE HAYFORD

Report of the Secretary

Most of the activities with which the Secretary has been concerned are included in the Report of the Board of Directors. It is customary for the Secretary to report certain statistics about the membership of the Association. During 1937 the membership increased from 1,875 to 2,044, a net growth of 169 members. During the year 268 new members were elected, and 33 former members were reinstated. Eighty-three members were removed from the membership for failure to pay their dues, 17 of whom were reinstated before the end of the year. Fifty-seven members were lost by resignation and nine by death. At the end of the year 38 applications for membership beginning January 1, 1938, had been received.

Membership Statement, December 31, 1937

Honorary members	19
Corporate members	5
Fellows.. . . .	91
Regular members	1,929
<hr/>	
Total membership	2,044

Two Fellows and two Regular Members were Contributing Members during 1937. Four members became Life Members during the year, bringing the total number of Life Members to 34.

The death of the following members was recorded during the year: Warren M. Persons, Fellow, and Alden W. Baldwin, William Butterworth, Walter S. Case, Mary Johnston, Edward P. Kreevoy, Howard S. Mott, L. D. Peavey, and Horace L. Wheeler, Regular Members.

FREDERICK F. STEPHAN, *Secretary*

Report of the Treasurer

During 1937, net cash receipts, apart from receipts for the sale of securities, exceeded those of the preceding year by more than \$1,000.00. This increase was principally due to an increase in dues, subscriptions, and JOURNAL sales more than sufficient to offset the decrease in The Rockefeller Foundation grant. Expenditures were increased in almost every category, reflecting increased activity and some new items of expense.

During the year, receipts from the sale of securities exceeded expenditures for the purchase of other securities by approximately \$4,500.00 leaving a large cash balance to be reinvested in accordance with the orders of the Committee on Investments as specified in the By-Laws. A net profit of \$1,280.29 was realized on the securities which were sold.

Investments are shown on the balance sheet at market value at the end of the fiscal year with cost figures for comparative purposes. The latter figures include the cost of certain shares of stock acquired during 1892 and 1893, the market value of which on December 31, 1937, was \$1,970.00 less than cost. The market value of the other securities held at the end of the year was \$2,347.73 less than cost. These changes in cash and investments are the principal changes reflected by the balance sheets during the last three years:

	December 31, 1935	December 31, 1936	December 31, 1937
<i>Assets</i>			
Cash.....	\$ 2,367.65	\$ 379.87	\$ 4,994.64
Investments (market value) ..	8,099.00	13,874.25	5,391.75
Receivables.....	234.29	202.78	169.25
Inventories ..	1,535.00	1,535.00	1,535.00
Furniture and equipment, less depreciation.....	648.18	575.05	582.16
Total assets.....	<u>\$12,884.12</u>	<u>\$16,566.95</u>	<u>\$12,672.80</u>
<i>Liabilities and Surplus</i>			
Unearned income ..	\$ 2,433.24	\$ 2,368.51	\$ 2,670.91
Bills payable ..	0.00	76.55	0.00
Special accounts ..	0.00	63.70	128.44
Life memberships.....	1,980.00	2,030.00	2,276.10
Corporate surplus.....	8,470.88	12,028.19	7,597.35
Total liabilities and surplus ...	<u>\$12,884.12</u>	<u>\$16,566.95</u>	<u>\$12,672.80</u>

A detailed balance sheet and statement of receipts and expenditures are attached.

FREDERICK F. STEPHAN, *Treasurer*

*American Statistical Association
Balance Sheet, December 31, 1937*

ASSETS

Current assets and investments:

Cash

Checking account (American Security and Trust Company)	\$ 4,585.60	
Savings account (Emigrant Industrial Savings Bank)	374.04	
Awaiting deposit	35.00	\$ 4,994.64
		<hr/>

Investments*		5,391.75
------------------------	--	----------

Receivables

Accrued interest	1.87	
Accounts receivable	67 38	
Dues receivable, less doubtful items	100.00	169.25
		<hr/>

Inventories

JOURNAL	\$ 1,500.00	
Special publications	35.00	\$ 1,535.00
		<hr/>

Furniture and equipment, less depreciation		582.16
		<hr/>

Total assets		<u>\$12,672.80</u>
------------------------	--	--------------------

LIABILITIES AND SURPLUS

Current liabilities:

Unearned income

Dues	\$ 1,013.75	
Subscriptions	1,637.00	
Miscellaneous credits	20.16	\$ 2,670.91
		<hr/>

Bills payable		0.00
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Special accounts:

The Rockefeller Foundation Grant		0.00
Allied Social Science Associations		128.44

Life memberships		2,276.10
----------------------------	--	----------

Corporate surplus		7,597.35
		<hr/>

Total liabilities and surplus		<u>\$12,672.80</u>
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* Market value, December 31, 1937. Cost \$9,709.48.

*American Statistical Association
Statement of Receipts, Expenditures, and Cash Balances*

December 31, 1936, to December 31, 1937

Cash on hand, December 31, 1936:

Checking account (American Security and Trust Company)	\$	13.21	
Savings account (Emigrant Industrial Savings Bank)		366.66	\$ 379.87
		<hr/>	

Net cash receipts, December 31, 1936, to December 31, 1937:

General account	\$25,697.11		
Special accounts:			
The Rockefeller Foundation Grant	6,000.00		
Allied Social Science Associations	130 00		31,827.11
	<hr/>		
Total			<u>\$32,206.98</u>

Net cash expenditures, December 31, 1936, to December 31, 1937:

General account	\$21,147.08		
Special accounts:			
The Rockefeller Foundation Grant	6,063.70		
Allied Social Science Associations	1.56		\$27,212.34
	<hr/>		

Cash on hand, December 31, 1937:

Checking account (American Security and Trust Company)	\$ 4,585.60		
Savings account (Emigrant Industrial Savings Bank)	374.04		
Awaiting deposit	35.00		4,994.64
	<hr/>		
Total			<u>\$32,206.98</u>

American Statistical Association
*Statement of Net Cash Receipts and Expenditures**
December 31, 1936 to December 31, 1937

	General Account	Special Ac- count: The Rockefeller Foundation Grant	Total
Receipts:			
Dues...	\$10,857.57	—	\$10,857.57
Subscriptions .	3,603.00	—	3,603.00
Advertising.	381.20	—	381.20
Reprints .	165.00	—	165.00
JOURNAL sales	799.38	—	799.38
Special publications .	65.97	—	65.97
Dividends and interest	872.58	—	872.58
Other receipts .	160.89	—	160.89
The Rockefeller Foundation Grant	—	\$ 6,000.00	6,000.00
<hr/>			
Total receipts, exclusive of sale of securities . . .	\$16,905.59	\$6,000.00	\$22,905.59
Sale of securities†	8,791.52	—	8,791.52
<hr/>			
Total receipts .	\$25,697.11	\$6,000.00	\$31,697.11
<hr/>			
Expenditures:			
JOURNAL: printing, mailing and re-prints . . .	\$ 5,231.25	—	\$ 5,231.25
Bulletin .	320.64	\$ 240.50	561.14
Salaries and wages	7,829.94	3,898.36	11,728.30
Rent .	456.26	623.74	1,080.00
Office supplies, printing and mimeo-graphing. . .	889.90	129.81	1,019.71
General postage and carriage .	518.53	51.19	569.72
Telephone and telegraph. . . .	124.12	89.42	213.54
Travel expense: officers .	547.96	570.54	1,118.50
Travel expense: committees	70.66	240.04	310.70
Mimeographing: committees	10.05	37.20	47.25
Furniture and equipment. . .	109.85	—	109.85
Old JOURNALS purchased.	127.05	—	127.05
Storage of old JOURNALS. . .	82.47	—	82.47
Other expense.	485.20	182.90	668.10
<hr/>			
Total expenditures, exclusive of purchase of securities. . . .	\$16,803.88	\$6,063.70	\$22,867.58
Purchase of securities.	4,327.20	—	4,327.20
<hr/>			
Total expenditures.	\$20,131.08	\$6,063.70	\$27,194.78

* Exclusive of special account for Allied Social Science Associations.

† Cost of securities sold, \$7,511.23; net profit realized, \$1,280.29.

Report of the Auditing Committee

We have examined the balance sheet of the American Statistical Association as of December 31, 1937, verified the cash, and checked the securities on hand. We have also examined the statement of receipts and expenditures.

In our opinion, the balance sheet is a correct statement of the financial condition of the Association and the receipts and expenditures statements are duly supported by accompanying vouchers.

D. C. ELLIOTT

ROBERT J. MYERS

*List of Committees and Representatives for 1937**Committee on Fellows**

William F. Ogburn
Emanuel A. Goldenweiser
E. Dana Durand
Walter A. Shewhart
F. Leslie Hayford

Committee on Nominations

Edwin B. Wilson, <i>Chairman</i>	Willard L. Thorp
Winfield W. Riefler	

Auditing Committee

D. C. Elliott	Robert J. Myers
---------------	-----------------

Committee on Investments†

Frederick R. Macaulay, <i>Chairman</i>	Dean Langmuir
Willford I. King	

Program Committee for the Denver Meeting

W. Randolph Burgess	Frederick F. Stephan
Carl Snyder	

Committee on Committee Organization and Activities‡

Meredith B. Givens, <i>Chairman</i>	Ralph G. Hurlin
Robert E. Chaddock	Horatio M. Pollock
Morris A. Copeland	Thorsten Sellin
W. Leonard Crum	Casimir A. Sienkiewicz
Neva R. Deardorff	Willard L. Thorp
Howard W. Green	
The President and Secretary, <i>ex officio</i>	

* With terms expiring at the end of 1937, 1938, 1939, 1940 and 1941, respectively.

† Appointed in accordance with By-Law 5 to supervise the investment of the Association's surplus funds

‡ Formerly the Committee to Stimulate and Coordinate Research.

Advisory Committee on the Census

Robert E. Chaddock, *Chairman*
Murray R. Benedict
Paul T. Cherington

J. Frederic Dewhurst
Frederick C. Mills
William F. Ogburn

Committee on Census Enumeration Areas

Howard W. Green, *Chairman*
Clarence E. Batschelet
Robert E. Chaddock
Neva R. Deardorff

Calvert L. Dedrick
Ernest M. Fisher
Leon E. Truesdell

Committee on Statistics of Delinquents and Criminals

Thorsten Sellin, *Chairman*
Ronald Beattie
G. E. Gehlke
Rolf T. Harbo

R. R. Lutz
Morris Ploscowe
Barkev S. Sanders
George B. Vold

Joint Committee on Income Tax Statistics (With American Economic Association)

W. Leonard Crum, *Chairman*
J. Franklin Ebersole*
Ralph C. Epstein*

David Friday
Robert M. Haig*
Simon Kuznets

Committee on Industrial Statistics

Willard L. Thorp, *Chairman*
Charles A. Bliss
C. R. Chambers
Stephen M. DuBrul

Joseph B. Hubbard
Leonard Kuvn
Howard H. McClure
Claudius Murchison

Committee on Labor Statistics

Casimir A. Sienkiewicz, *Chairman*
Ewan Clague
Carroll R. Daugherty
Margaret Elliott
O. A. Fried
Meredith B. Givens

Aryness Joy
Solomon Kuznets
Gladys L. Palmer
Eugene B. Patton
William H. Stead
Sidney W. Wilcox

Committee on Statistics of Institutions for Mental and Physical Disorders

Horatio M. Pollock, *Chairman*
G. W. Baehne
Frederick W. Brown
Kate H. Claghorn
Mary Augusta Clark

Emil Frankel
Carl E. McCombs
Elliott H. Pennell
David M. Schneider

* Appointed by the American Economic Association.

*Committee on Relief Statistics**

Ralph G. Hurlin, *Chairman*
 Neva R. Deardorff
 William Haber
 Saya Schwartz

Herman M. Somers
 Frederick F. Stephan
 Paul Webbink

Committee on Statistics of Dependent Children in Foster Care

Neva R. Deardorff, *Chairman*
 Raymond F. Clapp
 Emil Frankel
 Morris J. Karpf
 A. Wayne McMillen

Robert J. Myers
 David M. Schneider
 Emma Winslow
 Helen Witmer

Committee to Appraise the Statistical Evidence of the Causes of the 1929-1932 Business Collapse

Willford I. King, *Chairman*
 Seymour L. Andrew
 William A. Berridge
 Robert W. Burgess
 Paul T. Cherington
 John H. Cover
 Garfield V. Cox
 Carroll W. Doten
 George J. Eberle
 J. F. Ebersole
 Ralph C. Epstein
 Alfred T. Falk
 Irving Fisher
 F. Leslie Hayford
 Stanley B. Hunt

Harry Jerome
 Edwin W. Kemmerer
 Wesley C. Mitchell
 Otto Nathan
 Frank A. Pearson
 Horatio M. Pollock
 John R. Rigglesman
 George B. Roberts
 Norman J. Silberling
 Laurence H. Sloan
 Bradford B. Smith
 Carl Snyder
 Ralph J. Watkins
 Ray B. Westerfield

Committee on Biometrics

Lowell J. Reed, *Chairman*
 Joseph Berkson
 Robert E. Chaddock
 Selwyn D. Collins
 John Collinson

J. V. DePorte
 Alfred J. Lotka
 Hugo Muench, Jr.
 Richard E. Scammon

Committee on Sociometrics

George A. Lundberg, *Chairman*
 F. Stuart Chapin
 Calvert L. Dedrick
 Stuart A. Rice

Samuel A. Stouffer
 Dorothy S. Thomas
 George B. Vold

Committee on an Annual Review of Progress in Mathematical Statistics

Paul R. Rider, *Chairman*
 Burton H. Camp
 Cecil C. Craig

Walter A. Shewart
 Samuel S. Wilks

* Authorized to act with the Committee on Statistical Forms and Procedures of the American Public Welfare Association as a Joint Committee on Relief Statistics.

Representative on the Board of Directors of the National Bureau of Economic Research

Winfield W. Riefler

Members of the Social Science Research Council

Edwin B. Wilson (*For the term expiring December 31, 1937*)

William A. Berridge (*For the term expiring December 31, 1938*)

Stuart A. Rice (*For the term expiring December 31, 1939*)

Representative on the Council of the American Association for the Advancement of Science

William F. Ogburn

Representative on the Business Research Council

Donald R. Belcher

Representative on the Board of Directors of the New York Management Council

C. M. Armstrong, Jr.

Representative on the National Conference on Nomenclature of Disease

George H. Van Buren

Representative on the Joint Committee for the Development of Statistical Applications in Engineering and Manufacturing

Walter A. Shewhart

Representative on the Sectional Committee on Standards for Graphic Presentation

A. H. Richardson

Representative on the Conference on National Income and Wealth

Aryness Joy

Report of the Advisory Committee on the Census

The Census Advisory Committee, it may be recalled, has been reorganized on a new basis the past year and is now exclusively a committee of the American Statistical Association instead of being, as formerly, a joint committee of that Association and the American Economic Association. All members of the Committee are now appointed by the Board of Directors of the Statistical Association, which formerly appointed only three out of six, the other three being appointed by the Economic Association.

The duties of the Committee as defined by the Board of Directors remain substantially unchanged. Its primary function "is to advise with the Director of the Census either on his own initiative or that of members of the Committee with a view to promoting improvements in census procedures and data. It is authorized to consider means of improving conditions bearing upon the effectiveness of census procedures which may be beyond the

power of the Director to alter, to make relevant recommendations, and to transmit these to the Director of the Census, the Board of Directors of the Association, or both. It is invited to bring the attention of the Board, with its recommendations, any matters on which it believes that the American Statistical Association should take an official position. Except on instructions by the Association or its Board of Directors, the Committee is not authorized to speak for the Association as such."

The Committee has, however, a further function or responsibility not previously required of it, since at the request of the Director of the Census it will hereafter review and pass upon the recommendations of any special census committees, such as the Committee on Vital Statistics or that on Financial Statistics of States and Cities.

Two meetings of the Committee were held the past year—one on April 2 and 3 and the other on October 8 and 9.

The April meeting was devoted mainly to acquainting the new members with the organization and functions of the Census Bureau. The heads of the various divisions were successively called into the meeting to tell the Committee about their work, plans, and problems; and the Committee was shown the mechanical equipment of the Bureau.

The October meeting was devoted mainly to the consideration of legislation and plans for future censuses and other statistical compilations. A bill has been drafted within the Bureau providing for the regular decennial census to be taken in 1940 and every tenth year thereafter; also for a census of population, employment, unemployment, and agriculture to be taken in the fifth year following the decennial census; also for a quinquennial census of industry and business to be taken in 1943 and every fifth year thereafter, and to include such "basic statistics of manufacturing and extractive industries and of business, commercial, mercantile, service, and professional enterprises as the Director of the Census deems necessary for the promotion of industrial, business, and commercial welfare of the nation." The bill makes provision also for annual surveys on agriculture in intervals between censuses, and for the collection (monthly, quarterly, semi-annually, or annually) of basic statistics on industrial and business activities. In its main outlines this program of inquiries has already been approved by the former Census Advisory Committee.

Under this bill the regular decennial census in 1940 will cover population, employment and unemployment, housing, agriculture, irrigation, drainage, and horticulture.

The attention of the Committee was called to certain questions that are likely to be urged upon the Bureau for inclusion in the next population census involving the danger of overloading the schedule. This, it was felt, was a matter requiring careful consideration, and the Committee did not feel prepared or called upon to make any definite recommendations at this time regarding the questions that should be included. Other matters brought to the attention of the Committee included the date of the next

decennial census, the question of a census of housing, the use of trial schedules for the census of agriculture, the definition of a farm, and the advisability of securing statistics of farm products consumed on the farm.

The Committee reviewed and approved with some minor revisions certain resolutions adopted by the Special Committee on Vital Statistics. One of these recommended that a study of accidents be conducted as a series of sample inquiries over limited periods of time in cooperation with the several states.

The Committee considered also the set of resolutions adopted at a recent meeting of the Special Committee on Financial Statistics of States and Cities but felt that these should be given more study and required some redrafting before being approved.

The Director of the Census requested the views of the Committee regarding the cooperative arrangement recently entered into by the Bureau of the Census and the Bureau of Foreign and Domestic Commerce in regard to the compilation of current business statistics. The Census Bureau has for many years been engaged in the compilation—monthly, quarterly, or annually—of statistics showing the production, sales, or stocks on hand of various commodities, the list of which has steadily grown. The basic data are obtained for the most part from commercial or trade organizations or individual manufacturers reporting on a purely voluntary basis. Recently the question was raised of transferring this branch of the Bureau's work to the Bureau of Foreign and Domestic Commerce. This question was studied by a committee appointed by the Central Statistical Board. Hearings were held and attended by representatives of the two Bureaus; and the cooperative arrangement finally entered into is essentially along the lines recommended by that committee.

The arrangement is that the Bureau of the Census shall collect and compile the primary current business data; that the analysis, interpretation and publication of these data shall be the function of the Bureau of Foreign and Domestic Commerce; and that the selection of the series and form of inquiry shall be determined by a joint committee consisting of officials of both Bureaus and a representative of the Central Statistical Board.

The Advisory Committee, acting on the recommendation of a subcommittee appointed by the Chairman, expressed their approval of this cooperative arrangement placing emphasis upon the plan for having a joint committee to determine the series and form of the inquiries.

The Census Advisory Committee is now one of several committees in the Statistical Association concerned with the statistical activities of the Federal government. An effort is being made to cooperate with these other committees of the Association, so far as their work and interests relate to the activities of the Census Bureau. By joint meetings with the members of one or more other committees, in addition to the official sessions of the Committee at Washington, and by interchange of views, we hope to stimulate study

of the problems of the Census Bureau and to encourage carefully considered suggestions and recommendations to the Director, which may be transmitted either through the Advisory Committee or directly to the Bureau.

ROBERT E. CHADDOCK, <i>Chairman</i>	J. FREDERIC DEWHURST
MURRAY R. BENEDICT	FREDERICK C. MILLS
PAUL T. CHERINGTON	WILLIAM F. OGBURN

Report of the Committee on Census Enumeration Areas

The Committee on Census Enumeration Areas has been able to interest people in almost all the cities of a quarter of a million or more inhabitants in census tracts to the extent of preparing the necessary census tract maps for the approval of the Bureau of the Census. Practically all of these cities either have obtained official approval for their census tracts or are in the process of revising their maps so that approval may be gained.

A revised edition of the Census Tract Manual was published in July. This manual, prepared by the Chairman of the Committee and Doctor Leon E. Truesdell, Committee member, has aided people in various cities in preparing census tract maps and street indexes.

It is expected that several additional cities will become sufficiently interested to lay themselves out in census tracts during the next six or seven months. It is also expected that some of the older cities will desire to extend their census tracts to include adjacent suburbs. The Committee stands ready to be of help to such cities.

A midsummer meeting of the Committee was held in Washington for the purpose of discussing problems relating to census tracts presented by the Central Statistical Committee and the Works Progress Administration.

A midwinter meeting of the Committee will be held in Atlantic City. Representatives of 65 census tract cities or cities intensely interested in becoming census tract cities have been invited to this Atlantic City meeting as scheduled in the Association's program.

The Committee is still faced with such problems as those summarized below:

1. The creation of a broader use of census tract data within each census tract city: use by more organizations and in more different ways
 - (a) By making census tract maps
 - (b) By preparing and publishing a useable street index by which social and business data may be readily allocated to census tracts
 - (c) By demonstrating a variety of possible local uses
2. The preparation of definite recommendations regarding table forms which will be most useful to local communities in 1940 based on extensive experience with the 1930 forms and from the standpoint of local community interests.
3. The problems encountered in subdividing the less densely populated areas surrounding large cities

These problems are not yet solved, but progress is being made toward their solution.

It is believed valuable to continue the activities of this Committee for the promotion of the census tract idea both in new census tract cities and in those that have census tracts but have not taken full advantage of this "statistical tool."

HOWARD WHIPPLE GREEN, <i>Chairman</i>	CALVERT L. DEDRICK
CLARENCE E. BATSCHELET	ERNEST M. FISHER
ROBERT E. CHADDOCK	LEON E. TRUESDELL
NEVA R. DEARDORFF	

*Report of the Committee on Statistics of
Delinquents and Criminals*

The Committee has during the past year been very closely in touch with the work of the Bureau of the Census in the collecting and tabulation of judicial criminal statistics and the annual statistics of prisoners.

The criminal statistician of the Bureau and the chairman of the Committee have met on several occasions to discuss the problems involved.

The Committee, furthermore, has taken the initiative in urging that the census of institutions, which would ordinarily be taken in 1943, be taken in 1940 in order that a firmer population basis may be secured for the computation of ratios.

THORSTEN SELLIN, <i>Chairman</i>	R. R. LUTZ
RONALD BEATTIE	MORRIS PLOSCOWE
G. E. GEHLKE	BARKEV S. SANDERS
ROLF T. HARBO	GEORGE B. VOLD

*Report of the Committee on Statistics of Institutions for
Mental and Physical Disorders*

The Committee has met but twice in the past year. In consequence, it has been able to do little more than maintain contact with other agencies having the same statistical objectives, and through its individual members at work in related fields of state and national administration aid in the advancement of the Committee's general program.

This general program contemplates the establishment of a registration area for social welfare statistics, covering primarily the activities carried on by the Social Security Board, and the drafting of a model law for social welfare statistics especially adapted to the requirements of the institutional services with which the Committee is concerned. In furtherance of this purpose the Committee submitted a memorandum embodying these proposals to the Special Committee on Accounting and Statistics of the National Conference of Social Work at its annual session in Indianapolis in May of the

current year. No formal action, however, was taken by such Committee on the proposals submitted.

In view of the interest shown by the surgeon general, Dr. Thomas Parran, in the compilation of more uniform and comprehensive statistical data on the hospitals of the United States, and to aid him in this work, your Committee offered its cooperation to the surgeon general and requested the designation of a member of his staff to meet with the Committee. Mr. Elliott H. Pennell, who was so designated, has recently been appointed a member of the Committee. This cooperative relationship with the surgeon general's office offers an opportunity in the field of hospital statistics of which the Committee plans to take immediate advantage.

To further the Committee's plan for more complete and accurate statistics of hospitals throughout the country, the chairman has appointed a special subcommittee, under the chairmanship of Dr. Carl E. McCombs of the Institute of Public Administration, which includes Mr. Elliott H. Pennell of the surgeon general's office, to review the field of hospital statistics and work out during the coming year a simple hospital schedule which can be used by the surgeon general's office if desired or by other official and unofficial agencies concerned in the compilation of the minimum statistical data needed on the hospital services and facilities of the country. It is the Committee's view that in the hospital field simplification of statistical schedules is essential, because of the extremely wide variations in the types of hospital services rendered, their methods of accounting and record keeping, and the general lack of competent statisticians in the hospitals themselves. Accordingly the Committee proposes to limit the scope of its statistical effort in the hospital field to those data which can be uniformly and accurately recorded by hospital record clerks for the purposes of an annual statistical summary of hospital location, personnel, bed capacity, movement of population, income and expenditure, as a minimum. The preparation of a simple manual of instructions for compiling such statistical matter is contemplated.

Members of the Committee working individually in their respective fields of interest have continued to make material contributions to the betterment of hospital and other institutional statistics during the year. Among these contributions, special mention should be made of the work of Mr. Frederick W. Brown, as adviser to the Census Bureau, on statistics of hospitals for mental diseases and disorders, the reports of Dr. Emil Frankel, of the New Jersey Department of Institutions and Agencies, on trends in general hospital services in New Jersey, 1929-1936, and the work of Dr. David M. Schneider, of the New York State Department of Social Welfare in the development of uniform comprehensive statistics on the hospital services of New York State.

HORATIO M. POLLOCK, *Chairman*

CARL E. MCCOMBS, *Secretary*

GEORGE W. BAEHNE

FREDERICK W. BROWN

KATE H. CLAGHORN

MARY AUGUSTA CLARK

EMIL FRANKEL

ELLIOTT H. PENNELL

DAVID M. SCHNEIDER

Report of the Joint Committee on Relief Statistics

The Joint Committee on Relief Statistics, appointed by the American Statistical Association and the American Public Welfare Association, continued its interest in developments in the field of relief statistics throughout the United States. Meetings and committee discussions were held frequently during the year. The Committee also conducted four open meetings for discussion of problems of relief statistics, two in connection with the National Conference of Social Work held in Indianapolis in June, one during the conference of the American Public Welfare Association in Washington on December 11, and one during the annual meeting of this Association at Atlantic City on December 29. Three numbers of an informal *Bulletin of Information for Relief Statisticians* were issued during the year. This bulletin, which was inaugurated last year, appears to be serving a very useful function in keeping relief statisticians and others informed of new statistical developments in various fields of relief activity. It is now being distributed to about 400 persons. At the end of the year plans are completed for the publication of a series of papers dealing with practical problems in the compilation and use of relief statistics, the first number of which will be published in January.

The Committee has continued as last year to serve as an official advisory committee to the Division of Public Assistance Statistics of the Social Security Board. It has also given advisory service to the Works Progress Administration, the Special Senate Committee on Relief and Unemployment, and to certain state relief agencies. The Committee has given special consideration to the need for the preparation of consolidated statistics of the various federal relief programs and is able to report much progress in the production of such statistics within this year. At the end of the year special attention is being given to the need for developing standardized detailed statistics of large city relief operations, which have been entirely lacking heretofore.

RALPH G. HURLIN, <i>Chairman</i>	HELEN R. JETER
PAUL WEBBINK, <i>Secretary</i>	HOWARD B. MYERS
NEVA R. DEARDORFF	SAYA M. SCHWARTZ
EMIL J. FRANKEL	HERMAN M. SOMERS
HARRY GREENSTEIN	FREDERICK F. STEPHAN
WILLIAM HABER	

Report of the Committee on Labor Statistics

A conference to consider problems of occupational classification, the need for comparability in occupational statistics, and the practicability of a general-purpose classification framework was held in Philadelphia on April 23, 1937. The proposal to call this conference arose in a meeting of the Committee on Labor Statistics held in 1936, and the plans for the conference were developed by members of the Committee following that meeting. The program was arranged by a sub-committee consisting of Gladys L. Palmer,

Chairman, Margaret Elliott, Philip M. Hauser, Solomon Kuznets, and William H. Stead. A brief report of the conference was published in the May 1937 bulletin issued by the Association.

The conference made recommendations regarding the collection of the basic data for occupational statistics and the need of continued research on definitions of occupational terms used both for classifying jobs and for classifying persons in relation to the occupation of their usual or last employment. It was recognized that different sources of information created different problems in initial classification and coding.

The conference considered that the problem of securing convertibility between classifications at any desired level of detail necessitated the use of a universal basic code. They recommended further research on the nature of the differences between occupational codes now in general use and experimentation in cross-classification analysis of a given set of data in which the items are convertible. The desirability of developing occupational classifications in relation to classifications of industry and the status of the person as an employer, employee, unpaid family worker, or self-employed person was also stressed.

Following the conference, several informal meetings were held in Washington to consider the next steps that might be taken to increase the comparability between occupational classifications now in use. Two definite projects were outlined and tentative arrangements were made whereby these projects would be undertaken by the agencies primarily concerned.

Recognizing that the work of the Committee on Labor Statistics touches that of the Advisory Committee on the Census on several points, arrangements have been made for a joint meeting of the two committees early in January 1938.

C. A. SIENKIEWICZ, *Chairman*

Report of the Committee on Industrial Statistics

The Committee on Industrial Statistics has been inactive during the past year. The emergency conditions under which it was created appear largely to have disappeared. While there has been some discussion of this Committee acting in an advisory capacity to certain of the Government agencies, we do not believe that this possibility justifies the continuance of the Committee. If the Association should be requested to provide such an advisory committee, a new committee could easily be established. We therefore recommend our discontinuance.

However, the Committee does wish to recommend to the Board of Directors that an award be established for outstanding trade association statistical work. The trade association is frequently at the center of industrial statistics. The members of an industry are able to judge a statistical program in terms of its immediate utility, but are not able to evaluate it from the point of view of statistical standards. The purpose of the award would

be to recognize and encourage high-grade statistical work by trade associations. A definite plan for two awards has been transmitted to the officers of the Association. The first award for excellence in statistical work would recognize a strong, solid statistical program, although it might have been in operation without major change for a considerable period of time. The second award would be given for an outstanding contribution during the year, either in the form of a marked improvement or development of new data or in some special study worthy of recognition. In both cases the work would not need to have been done exclusively by the staff of the association, but it would have to be sponsored by and properly credited to the association responsible for its accomplishment.

WILLARD L. THORP, <i>Chairman</i>	JOSEPH B. HUBBARD
CHARLES A. BLISS	LEONARD KUVIN
C. R. CHAMBERS	HOWARD H. McCLURE
STEPHEN M. DuBRUL	CLAUDIUS MURCHISON

Report of the Joint Committee on Income Tax Statistics

The Committee has held no stated meeting during the year. The Chairman, at the request of the Treasury, met with representatives of the Treasury and particularly of the Bureau of Internal Revenue in February, 1937, to confer concerning changes in the tabulation of corporation data for 1936, necessitated by the Revenue Act of 1936. The changes made here were not in general deep-reaching but took account of the new kinds of information which were given effect by the 1936 Act. The Chairman called informally certain other members of the Joint Committee about some of those changes but did not regard the matter as of sufficient complexity to warrant a general meeting of the Committee.

During the autumn, the Treasury asked the Chairman to reopen on a broad scale the entire question of tabulations of statistics of income and to appoint a Committee within the Treasury, of which the Chairman of our Joint Committee would be Chairman, to survey the whole case. Current emergencies in the Treasury have prevented the institution of this new committee but the Chairman expects to appoint such a committee in the near future, and, in connection with the work of that committee within the Treasury, the Joint Committee will be called together to participate in a general overhauling of existing tabulations, both for corporations and individuals. It is probable that the new set of changes will be worked out early in 1938 and be used for tabulation of 1937 data and the changes will be more extensive and important than those introduced in 1931.

W. L. CRUM, <i>Chairman</i>	DAVID FRIDAY
J. F. EBERSOLE*	ROBERT M. HAIG*
RALPH C. EPSTEIN*	SIMON KUZNETS

* Appointed by the American Economic Association

*Report, by the Chairman, of the Progress made by the Committee
on the Statistical Evidence Concerning the Causes of the
1929-1932 Business Collapse*

On May 16, 1936, the Board of Directors of the American Statistical Association authorized the formation of a Committee to Appraise the Statistical Evidence Concerning the Causes of the 1929-1932 Business Collapse. This Committee was constituted because of the feeling on the part of some members of the Board that, at the present time, a considerable number of statistical facts relating to the causes of depression have been so thoroughly established that they are accepted by a large majority of leading members of the statistical fraternity. It was felt that, if this condition should prove to be true, a public service might be rendered by ascertaining just what statistical evidence is so accepted. With this end in view, a committee consisting of the following members was appointed—

Willford I. King, *Chairman*
Irving Fisher
Horatio M. Pollock
John R. Rigglesman
Frank A. Pearson
Ralph C. Epstein
Bradford B. Smith
John H. Cover
Garfield V. Cox
Ray B. Westerfield
Leonard P. Ayres
Wesley C. Mitchell
A. T. Falk
Harry Jerome
Leo Wolman
Ralph J. Watkins

Norman J. Silberling
Edwin W. Kemmerer
Otto Nathan
Carl Snyder
Edwin B. Wilson
George J. Eberle
George B. Roberts
William A. Berridge
Robert W. Burgess
Paul T. Cherington
F. Leslie Hayford
Laurence H. Sloan
Stanley B. Hunt
Carroll W. Doten
J. F. Ebersole
S. L. Andrew

The Committee was purposely made large in order to make it as representative as feasible of the statistical opinion of those members of the Association especially interested in questions relating to the business cycle.

Because of the size of the Committee, it did not seem feasible to make progress at a meeting unless steps could first be taken to clear the ground and determine what points of agreement existed and what differences were in need of discussion. As a preliminary measure, therefore, the Chairman sent out to the members of the Committee 22 specific propositions. Each one of these propositions was accompanied by charts, tables, or both, believed to assist materially in establishing the validity of the proposition. It was, of course, assumed that the members of the Committee would view the statistical evidence presented in the light of their knowledge of other statistical evidence and other events in general.

Each member of the Committee was requested to vote in one of three ways:—

1. That the statistical evidence is adequate to establish the validity of the proposition.
2. That the validity of the proposition would be established, provided the proposition were amended in a way specified by the voter.
3. That the statistical evidence is not sufficient to establish the validity of the proposition. Each voter was asked to state his reasons for believing the evidence was insufficient.

The process of canvassing the Committee took considerable time. On the first 18 propositions, 29 members eventually sent in their votes, though on some of them only 27 or 28 voted. On the last 4 propositions the maximum number of votes cast was 23.

The propositions, and the votes as recorded, are as follows:—

PROPOSITION I

In the years immediately preceding the 1929–1932 decline, the volume of physical production in the United States did not, to any *unusual* extent, rise above its long-time trend, as indicated by the data for the years 1860–1930.

Twenty-nine members voted on this proposition. Of this number 18 believed the proposition valid in general, though some members note exceptions in the case of certain industries. Two hold that the trend from 1860 to 1930 cannot be considered representative of the long-time forces governing American industry. Nine consider the evidence on the proposition unconvincing.

PROPOSITION II

In the years immediately preceding the 1929–1932 decline, stocks of goods on hand in the United States did not, in general, rise to any *unusual* extent above their long-time trends.

Twenty-nine members voted. Of these, 14 members hold the proposition probably true, but 4 of these consider the evidence inconclusive. Fifteen believe either that the evidence is non-representative of commodities in general, or that the period 1919 to 1930 is too short to indicate the long-time trend.

PROPOSITION III

Larger than usual stocks of cotton were on hand before the 1928–1929 boom. Since they did not prevent the development of the boom, it is unlikely that they were a primary initiating cause of the 1929–1932 decline.

Of the 28 members voting on this proposition, 16 approve it. Of the other 12, more object to the conclusion than to the statistical evidence. Some apparently feel that, even though the presence of large stocks of cotton did not prevent the boom, they may have contributed to the collapse which followed.

PROPOSITION IV

Abnormal accumulation of stocks of copper began with the depression and did not precede it.

Twenty-eight members voted on this proposition. Of these, 18 believe the evidence sufficient to establish the proposition. Some of the others are in doubt concerning the adequacy of the data. Two point out that the stocks recorded were mainly those in the hands of producers, and that these stocks might not be typical of the stocks in the hands of consumers of copper.

PROPOSITION V

In the years immediately preceding the 1929-1932 decline, overcapacity, as computed on the basis of effective demand, was, in general, not abnormally large in the manufacturing field.

Of the 28 members voting on this proposition, 17 agree with the findings of the Brookings Institution investigators that, at the time specified, overcapacity was, in most fields of manufacturing, not larger than normal. Most of those failing to approve this proposition refuse to do so because they believe that the evidence presented must, necessarily, be based upon factors not really subject to measurement.

PROPOSITION VI

In the period immediately preceding the 1929-1932 decline, the volume of unemployment among able-bodied workers was small.

Twenty-eight members voted on this proposition. Of these, 21 agree that there was but little unemployment in the early part of 1929. Four others agree that the statement is probably not far from the truth. Three believe the evidence unconvincing.

PROPOSITION VII

In the years immediately preceding the 1929-1932 decline, the proportion of the national income invested in production goods was not abnormally large, at least as compared to other post-war years.

Of the 28 members voting on this proposition, 19 agree that the evidence is convincing. Two question the definiteness of the term "production goods." One doubts the accuracy of the statistics, and six are unconvinced by the charts presented.

PROPOSITION VIII

In the United States, in years immediately preceding depressions, the volume of bank credit has nearly always risen well above its short-time trend, and also above its long-time trend.

Of the 28 members voting on this propositions, 21 believe the evidence adequate. Two feel that, while the proposition may be true, it is not significant. Two consider the proposition probably true, but the statistics inadequate. Three are unconvinced by the charts presented.

PROPOSITION IX

Before the 1929 crash, there was an unusual expansion in the volume of brokers' loans.

Out of the 29 voters, 25 agree to the proposition. The other four are apparently deterred from approving by the fact that data for years before 1923 were not presented for their consideration.

PROPOSITION X

The 1929 crash was preceded by an unusually sharp increase in the velocity of circulation of bank deposits, especially in New York City.

Of the 29 voting on this proposition, 23 agree that velocity, especially in New York City, increased sharply before 1929. Two feel that the increase outside New York City was not "sharp." Four believe that the short time covered by the evidence makes it impossible to say how "unusual" the increase was.

PROPOSITION XI

That the crash leading to the depression resulted from some quick-acting force is indicated by the suddenness of the onset of the depression.

Of the 29 voters, only 9 consider this proposition established. Nine others believe that the decline, though sudden, may well have represented merely a crash caused by a slow accumulation of forces, the weight of which finally passed the breaking point. Eleven object on miscellaneous grounds.

PROPOSITION XII

Production collapsed in 1929 because of a shrinkage in demand—that is, because new orders for goods were not forthcoming.

Of the 28 members voting, 17 agree that failure in demand was the immediate cause of the collapse, but three of these point out that the failure was marked mainly in the field of indirect and durable goods rather than in the field of perishable consumable goods. One member while agreeing that failure of demand was probably the immediate cause believes that the question of real importance is why demand failed. One other feels it possible that *fear* of failure of demand might have caused production to shrink even before new orders began to fall off. Four believe that shrinkage in demand was but one of the forces responsible for the decline in business. Five express doubt as to the validity of the proposition.

PROPOSITION XIII

One important reason for the collapse in the demand for corporate stocks and goods in general was the curtailment in the volume of buying on credit—such curtailment being due either to the exhaustion of the credit of the potential buyer, or to a decline in optimism concerning the future outlook for business.

Of the 29 voters, only 11 are convinced that either exhaustion of credit

or a decline in optimism, with a resultant shrinkage in credit buying, caused the sharp contraction in the volume of new orders for goods. Two others feel that the forces cited were but partially responsible for the decline in orders. Most of the other 16 feel that the decline in optimism and purchasing on credit might, in reality, not have been causal factors, but merely resultants of other forces.

PROPOSITION XIV

Nervousness concerning the future of stock prices was due largely to the unusual altitude reached by price-earnings ratios.

Of the 28 members voting, 15 believe that nervousness concerning stock prices was caused largely by the unusual altitude of the price-earnings ratios. Three others feel that this point of view ascribes too high a degree of rationality to the actions of stock speculators. Ten members are in doubt.

PROPOSITION XV

The shrinkage in the volume of stock buying on credit followed a period in which the ratio of brokers' loans to the national income had risen to an unusual height. Therefore, overexpansion of credit may have been partly responsible for the later shrinkage in the volume of stock purchasing on the basis of credit.

Of the 27 votes cast, 19 indicate a belief that overexpansion of credit, and hence, possibly, exhaustion of the credit of the buyers may have been a material factor in producing the shrinkage which occurred in the volume of stock purchasing on credit. Eight are either in doubt or feel the evidence inconclusive.

PROPOSITION XVI

The collapse in general production and employment followed the collapse in buying on credit and also the collapse in new orders.

Reference to the chart shows that brokers' loans began to decline sharply in October, 1929, while the steep decline in general production came a month later.

New orders reached their peak in March, 1929, and were well on their way down before employment started to slump severely in November.

Automobile credit was falling off rapidly in August and September, while production and employment showed no marked downward tendency before November.

Of the 28 voters, but 13 subscribe to the approximate correctness of all the statements in this proposition. Two others agree with most of the statements. Thirteen others are not convinced by the evidence.

PROPOSITION XVII

The intensity of the depression was accentuated by the fact that numerous banks failed and thereby curtailed the buying power of their depositors. Furthermore, such failures frightened other buyers, even though these other buyers lost nothing through the failures.

Of the 29 voting on this proposition, 24 agree to the validity of the statement. The other 5 emphasize the fact that the last statement in this proposition represents nothing more than an inference.

PROPOSITION XVIII

The decline in business was accentuated by the fact that, as the total dollar demand for their products shrank, manufacturers (especially those making durable production goods) did not reduce prices on their products sharply enough to keep up their usual volumes of sales, and did not cut hourly wage rates enough to keep up their usual volumes of employment. The resulting unemployment not only reduced the buying power of those laid off, but, by frightening those still employed, caused them to curtail their purchases.

Of the 28 voters, 14 give general approval to the proposition. Two others approve all but the last sentence of the statement. A number of the remaining 12 stress the fact that demands for different types of goods differ greatly in elasticity, and that no reasonable reductions in the prices of certain indirect goods would be likely to increase markedly the volumes of such goods sold, for the orders for such indirect goods are based primarily upon activity in preparing consumption goods.

PROPOSITIONS XIX AND XX (not submitted)

PROPOSITION XXI

With few exceptions, a high correlation exists between any marked price-change and the subsequent volume of trade and employment. The more marked the price-change, the more marked the correlation. For the period from December 1918 to August 1922, inclusive, the fluctuations of the volume of trade followed almost precisely the course they should, if assumed to be guided solely by antecedent price-change. The correlation between T (volume of trade) and P (price-change after a lag duly distributed) was 0.972.

On this proposition, 23 members voted. Of this number, 9 endorsed the proposition as stated; 6 others agreed in principle, but desired modifications in the wording; and 8 felt the evidence to be unconvincing.

PROPOSITION XXII

Countries on a common monetary standard usually experience like movements in the wholesale prices of articles entering largely into international trade.

This proposition was supported by 13 of the 22 members voting on it. The dissidents objected mainly on the ground that the evidence presented covered too few years to be conclusive.

PROPOSITION XXIII

In countries having unlike monetary standards, the movements of index series representing the prices of goods commonly entering into international trade are often very dissimilar.

Of the 21 members voting on this proposition, 14 held it to be valid. Some of the remaining 7 felt that the evidence was inconclusive, while others voted "No" because they feared erroneous implications would be drawn from the statement.

PROPOSITION XXIV

In any two countries that differ in monetary standards, the divergence in their price levels, as measured by commodities commonly entering into international trade, usually corresponds in a broad way with the divergence between the monetary standards of the two countries. This principle really includes as a special instance, the case of countries on the same monetary standard. In these countries, the divergence in price levels is apt to be negligible.

On this proposition, 22 members voted. Of this number, 14 considered the principle reasonably well established. Several of the 8 who were unconvinced felt that the proposition could not be established without presenting data for longer periods and more countries.

GENERAL CONCLUSIONS

From the votes recorded, it is clear that only a few of the propositions presented were supported by an overwhelming majority of the Committee. Of the 22 propositions submitted, 8 were favored by at least two-thirds of those voting, and 7 more commanded the support of three-fifths of the voters. In all, 16 propositions were approved by a majority of those voting, the remaining 6 failing to win majority approval.

The propositions cover a wide range. Opposition to the different propositions as stated is based upon a great variety of grounds. Under the circumstances, it appears that there would be little hope of securing from the Committee a statement acceptable to all the members unless the Committee met and worked vigorously for several weeks. Because of lack of funds to cover the expenses of such a conference, and because, presumably, few of the members would be willing or able to devote the needed time to it, the only feasible procedure seems to be to submit this report based upon the votes and expressed opinions of the voting members.

The chairman recommends that the committee be not reappointed.

WILLFORD I. KING, *Chairman*

Report of the Committee on Biometrics

The Committee on Biometrics was appointed in the fall of 1935 following some preliminary discussions between Dr. Joseph Berkson of the Mayo Foundation, Professor Lowell J. Reed of the Johns Hopkins University and Mr. Frederick F. Stephan, Secretary of the American Statistical Association, as to the possibility of establishing within the Association a Biometric Section to be devoted to biological applications of statistics.

At the Annual Meeting in December 1935 the Committee met with other

members of the Association to discuss the proposal. The response of the group was very favorable. Following this meeting a circular questionnaire was sent to a larger group of some 300 persons, members of the Association and others who might be interested, asking for a general reaction to the proposal and specifically whether they would attend a meeting of the Committee to be held at the time of the 1936 Annual Meeting of the Association in Chicago.

The replies indicated very definitely the soundness of the project. The meeting was held on December 27, 1936, with Dr. Reed acting as Chairman. Thirty-four persons attended, representing a considerable variety of biologic interests and a wide geographical distribution of the country. After a review of the purposes of the meeting by the chairman, Mr. Stephan spoke to the group on behalf of the ASA. He informed the group that conversations with the responsible officers of the Association indicated that the formation of a Biometric Section was looked upon very favorably and that cooperation of the Association was assured. He explained that an amendment to the Constitution providing authority for the establishment of sections was to be presented for approval at the Annual Business Meeting but that it could not be adopted until the next Annual Meeting. He suggested that pending the formal establishment of a biometric section, the Committee could go forward with its plans and activities as though the section were established and with the cooperation of the officers and other members of the Association. Specifically, he invited the organization of a biometric program for the next Annual Meeting of the Association and promised to make place for it on the general program. Professor Snedecor suggested that the section be called the "Bio-statistics" rather than the "Biometric" section, but this suggestion was not favorably received. Dr. Reed, as Chairman, Dr. Berkson, as Secretary, and Professor Snedecor were instructed by the Committee to continue and carry forward appropriate plans for a program at the 1937 Annual Meeting.

During 1936 Dr. Reed, Dr. Berkson, and Professor Snedecor had arranged a program for the 1936 Annual Meeting in addition to the meeting of the Committee. It included a round table on vital statistics in relation to the 1940 census and two sessions for the presentation of scientific papers on Vital Statistics and on Statistical Methods for Experimental Data. These sessions proved to be of very considerable interest.

One of the organizational problems which the Committee discussed was the overlapping of interests of the biometric section with other organizations, such as the American Association for the Advancement of Science and the American Public Health Association. To meet this the idea of joint meetings with such associations was put forward. Several members of the biometric group who were interested in population problems proposed such a session with the American Public Health Association. The proposal was accepted and a joint meeting was held with the Vital Statistics Section of the APHA on October 8, 1937, at the Hotel Pennsylvania in New York

City. The program covered various statistical aspects of studies on population, and the meeting was a notable one, both from the point of view of the fine quality of the papers and the attendance.

During the year plans were completed for a biometric program for the 1937 Annual Meeting of the ASA. Dr. Halbert Dunn, Chief of the Bureau of Vital Statistics, having been meanwhile elected Vice-President of the ASA, with responsibilities to include biometry and vital statistics, became the liaison officer between the Biometric Committee and the Association. Papers were solicited by the secretary of the Committee as well as by Dr. Dunn, prospective titles reviewed, and a program finally arranged consisting of twelve papers to be given at three sessions of the Annual Meeting in Atlantic City, December 28-29, 1937.

JOSEPH M. BERKSON, *Secretary*

Committee on an Annual Review of Progress in Mathematical Statistics

The Committee on an Annual Review of Progress in Mathematical Statistics met at the Commodore Hotel, New York City, Friday afternoon, February 12, 1937. Present were Burton H. Camp, Paul R. Rider, Walter A. Shewhart, Frederick F. Stephan, and S. S. Wilks.

It was decided that instead of proceeding with an annual review, such as that of J. O. Irwin published in the *Journal of the Royal Statistical Society*, it would be better to have reviews of different topics, starting from the beginnings and carrying the developments up to date. The Committee deemed it advisable to have some of these topics discussed at meetings and later written up for publication. The arrangement of the first session of this character was given over to Professor Camp, Vice-President for Statistical and Actuarial Methods and Technique, and the Teaching of Statistics. Professor Camp arranged two extremely interesting sessions for the Atlantic City meetings, one on the chi-square test and another on fiducial probability. For details of these sessions the program of the Ninety-ninth Annual Meeting* may be consulted.

It might be mentioned that the Institute of Mathematical Statistics is holding a session in Indianapolis on applications of mathematical statistics to industry and engineering. There will also be invited addresses "On the independence of certain estimates of variance," "The theory of general means," and "The future of the Institute in relation to mathematical statistics," as well as a joint session with the American Mathematical Society for the presentation of research papers on probability and allied topics. These sessions and the sessions of the Association on mathematical statistics have been scheduled at times which do not conflict, so that those desiring to do so may attend both.

* This JOURNAL, pp. 179-180.

It has been suggested that in view of the new direction that the activities of the Committee have taken, its name be changed to the Committee on Reviews and Monographs in Mathematical Statistics, or some similar appropriate title.

PAUL R. RIDER, *Chairman*
BURTON H. CAMP
CECIL C. CRAIG
WALTER A. SHEWHART
SAMUEL S. WILKS

*Report of the Representative on the Joint Committee for the
Development of Statistical Applications in
Engineering and Manufacturing*

In response to many requests for assistance in writing experimentally definite design and inspection requirements on quality of manufactured product, the Committee has given special emphasis to the development of an operationally verifiable technique of specifying requirements as to accuracy and precision. Members of the Committee have also cooperated during the past year with three societies in arranging programs dealing with the applications of statistics in engineering; have refereed several papers on applied statistics; assisted in the preparation of handbook material; answered many inquiries coming directly from those applying statistics in industry; sat in by invitation at the meetings of certain engineering committees engaged in establishing economic tolerance limits; and continued to cooperate with standardizing groups both here and abroad in the consideration of problems involving the use of statistical methods.

The Institute of Mathematical Statistics has become a joint sponsor and has appointed Professors Paul R. Rider of Washington University and S. S. Wilks of Princeton University as representatives. The American Society for Testing Materials has appointed as a second representative Mr. A. G. Ashcroft, Product Engineer, Alexander Smith and Sons Carpet Company.

A meeting of the Committee was held at Indianapolis on December 30th to discuss plans for the ensuing year.

W. A. SHEWHART

*Report of the Representative on the Board of Directors of the
National Bureau of Economic Research*

In December, 1937, *National Income and Capital Formation, 1919-1935, A Preliminary Report* by Simon Kuznets was published. The measures of national income and capital formation presented in this volume resulted from three studies that have been carried on at the National Bureau: *National Income and Capital Formation* by Dr. Kuznets and *Capital Consumption* by Solomon Fabricant. The study of capital formation was under-

taken at the request of the Committee on Banking and Credit of the Social Science Research Council.

The measures of national income contained in the volume constitute a complete revision of the estimates for 1919-28 by W. I. King and their continuation through 1935. The measures of commodity flow and capital formation constitute a revision and amplification of preliminary estimates of somewhat narrower scope released in Gross Capital Formation, 1919-1933 (*Bulletin 52*, National Bureau of Economic Research, November 15, 1934).

This volume is to be followed early in 1938 by the final report on *Commodity Flow and Capital Formation*, Volume I, which is now in press.

Also in December the first volume of the *Studies in Income and Wealth* by the Conference on Research in National Income and Wealth was released by the National Bureau for the Conference. This volume contains eight papers presented and discussed under the auspices of the Conference at the meetings of the American Economic and Statistical Associations in 1936 and at the second annual meeting of the Conference, January, 1937.

Four *Bulletins* (Numbers 65, 66, 67 and 68) were published, September to December, 1937: Non-Farm Residential Construction, 1920-1936, by David L. Wickens and Ray R. Foster; National Income, 1919-1935, by Simon Kuznets; Technical Progress and Agricultural Depression, by Eugen Altschul and Frederick Strauss; and Union Membership in Great Britain and the United States, by Leo Wolman.

Upon the recommendation of the Universities-National Bureau Committee, an Exploratory Committee on Research in Fiscal Policy was organized to consider the desirability and practicability of a study of fiscal policy. The Committee is now drafting its recommendations. Plans for the inauguration of the program of financial research were completed during the year and steps are now being taken to begin two studies: (1) consumer credit and installment financing; and (2) changes in the capital requirements of banks, the future of commercial loans, and the demand for short term capital loans.

The National Bureau's annual report will be published following the Annual Meeting of the Board of Directors on February 7, 1938.

WINFIELD W. RIEFLER

Report of the Representative on the National Conference on Nomenclature of Disease

Beginning with March 1, 1937, the financial support necessary to carry on the work of the National Conference which, essentially, is to perfect the *Standard Nomenclature* and to keep it abreast of progress in medical knowledge, has not been available. Accordingly, the Executive Committee proposed to the American Medical Association that it take over the *Standard Classified Nomenclature of Disease*. The Board of Trustees of the American

Medical Association has voted to do this, and all the records, copyrights, books on hand, and other materials have been duly transferred to the American Medical Association.

At a final meeting of the Executive Committee of the National Conference on Nomenclature of Disease, November 4, 1937, it was decided to discontinue the Committee but to maintain the National Conference itself. This action was taken in order that the National Conference might be in a position to give its assistance and advice to the American Medical Association in the event that that body should ask it.

GEORGE H. VAN BUREN

*Report of the Representative on the Sectional Committee
on Standards for Graphic Presentation*

The Sectional Committee on Standards for Graphic Presentation, sponsored by the American Society of Mechanical Engineers, has continued its activities during the year largely through subcommittees assigned to specific projects. The Chairman is Willard T. Chevalier, Vice-President, McGraw-Hill Book Company, Inc.

The Subcommittee on Engineering and Scientific Graphs, Walter A. Shewhart, Chairman, is continuing its efforts through a sub-group which is developing a brochure on "Engineering and Scientific Graphs for Publication."

The Subcommittee on Preferred Practice in Graphic Presentation, A. H. Richardson, Chairman, is revising its report on Time-Series Charts which was issued in tentative form by the American Society of Mechanical Engineers in April 1936. It is expected that this manual will be issued under the title, "Time-Series Charts—A Manual of Preferred Practice," when approved by the Sectional Committee, the A.S.M.E., and the American Standards Association.

A. H. RICHARDSON

*Report of the Representative on the Council of the American
Association for the Advancement of Science*

At the meeting of the American Association for the Advancement of Science in Indianapolis, Professor Wesley C. Mitchell was elected President. His election is a very distinguished honor and the choice of a social scientist to be president of the largest organization of scientists in America is a noteworthy recognition of the growing importance of social science. Mr. H. R. Tolley, Administrator of the Agricultural Adjustment Administration, was elected a Vice-President and Chairman of Section K. It is of interest that the meetings were grouped about the central theme "Science and Society." The American Association for the Advancement of Science is seeking to widen its influence among the younger scientists and the social scientists.

WILLIAM F. OGBURN

NOTES

MR. W. S. GOSSET

Statisticians all over the world will deplore the news of the death of Mr. W. S. Gosset, on 16th October 1937 in his 61st year of age. It is true that the name of Gosset will not be recognized by many of them. As far as I know, during his 30 years of scientific activity he used it only once, when reading a paper before the Industrial and Agricultural Research Section of the Royal Statistical Society, in Spring 1936. Usually he signed his works with the pseudonym "Student" and by this name he is known all over the world. In fact, it is hardly possible to find a single volume of any journal dealing with mathematical statistics or its applications, and published within the last five or perhaps ten years, in which "Student's" work is not quoted or at least, used. To see this let us remember that the test of significance of a mean or of a regression coefficient usually requires the use of "Student's" distribution. This popularity is the more remarkable, as the number of papers published by "Student" is relatively small: I know of about 20 and probably it does not exceed 25.

Mr. Gosset started his education in Winchester and graduated in mathematics and chemistry at Oxford. Then he obtained an appointment at the Dublin Brewery of Messrs. Arthur Guinness, Son and Co. He worked in this firm till the end and died as the Chief Brewer.

Mr. Gosset's contact with, and his interest in, mathematical statistics was due to a lucky idea of one of his superiors at the Brewery. He happened to read a book on probability and, as Mr. Gosset explained it once himself, thought that "there may be some money in it." He called on Gosset and suggested that he should go to London and study the probability theory at the University College under Karl Pearson, whose fame as a leader in this field was already well established. Accordingly, Mr. Gosset came to the Biometric Laboratory and spent some time there in 1906-1907. This was the beginning of a lasting and fruitful contact. In later years, working permanently in Dublin,* he would occasionally come to London and visit the Statistical Department where he had many friends. Many of Mr. Gosset's papers, including his first of 1907 and his last, which is now at the press, are published in *Biometrika*.

In order to appreciate fully the importance of "Student's" scientific work, we must keep in mind that the most difficult part in research is to notice the existence of important problems to be solved and to produce some sort of solution, however inadequate it may be. This requires a special equipment of the worker: a very broad outlook and what may be called scientific initiative in the best sense of the word. Frequently the results of such pioneer work are not perfect and the first solutions of the problems, or even

* A short time before his death Mr. Gosset's residence was transferred to London.

their statements, fail to be entirely satisfactory. Still, they mark the real progress of the science. Their formal defects, if any, are of minor importance. Other workers after being shown the problem, will work on it, correcting, developing, expanding.

"Student" possessed to a marked degree the gifts that are necessary for pioneer work and used them most successfully. At the time he started his scientific work, the theory of statistics was concerned mainly, if not entirely, with problems of large samples, such as occur in certain biological and social studies. Foremost among "Student's" achievements is that he stated and solved a number of fresh statistical problems connected with the work of big industrial organizations, such as the Guinness Brewery. They included: applied bacteriology, laboratory analyses, agricultural experimentation, time series analysis, etc., etc., and, above all, the problem of small samples which is involved in many of these fields of research. It is true that some statistical work in the directions mentioned already had been done but it was exceedingly rare and then no special methods seem to have been devised for the purpose. The methods which were applied, were borrowed from other fields and uncritically transplanted. Thus the respective workers had opportunities to see problems of mathematical statistics which were of considerable importance, but failed to see them. The most important thing that they overlooked and that "Student" noticed, was that they had to deal with small samples and that these require special methods, special distributions and tables. There was some theory concerning small samples published before, but the relevant publications were known only to a few mathematicians who had no knowledge of applicational problems. Those on the other hand who had to deal with applications, did not know the available theory. "Student" was the man to formulate the applicational problems and to start anew or, partly, rediscover the necessary theory. Let us give a few examples.

"Student" started with the problems of applied bacteriology and rediscovered and introduced for their study the Poisson Law of frequency. This formed his first paper.* A lively discussion followed with many participants including Karl Pearson. Now the number of papers written on the subject is very considerable and the applications of the Poisson Law to certain bacteriological problems well established.

"Student's" next and certainly the most important paper was "On the Probable Error of a Mean,"† containing the famous "Student's" distribution and a small preliminary table of its integral. Previous workers on applicational problems frequently had occasion to calculate the familiar ratio $z = \bar{x}/s$, where both the numerator and the denominator are based on a small number of observations. To test the significance of the mean \bar{x} , it was customary to refer $z\sqrt{n-1}$ to the normal scale of frequency and nobody

* "Student": "On the Error of Counting with a Haemocytometer," *Biometrika*, Vol. V (1907), pp 351-364

† *Biometrika*, Vol. VI, (1908), pp 1-24.

seemed to suspect that the variability of the denominator s might invalidate the test. The excellent scientific initiative of "Student," perhaps combined with, or influenced by, that of Karl Pearson, induced him to study directly the distribution of z itself. In doing so he rediscovered the distribution of s , previously found by Helmert, but then entirely forgotten.

It would be impossible to exaggerate the importance of "Student's" z test. The number of papers written by various writers on this subject is simply enormous and a textbook on statistical methods is unthinkable without a considerable section concerning that test. Apart from its own value as a statistical tool, its discovery played an important rôle as a stimulant to the study of small samples and of the general problem of testing statistical hypotheses.

As the third example of "Student's" pioneer work I shall quote his first paper on agricultural experimentation,* which should be rightly considered as a starting point of an extensive theory which is now well known. There were several further papers by "Student" on the subject, including his last, now in print in *Biometrika*, which deals with the difficult problem of the advantages and disadvantages of systematically balanced layouts.

Finally an important paper† on "Errors of Routine Analyses" should be mentioned. It is difficult for me to judge how far it influenced the procedure followed in industrial works where a permanent control of quality is kept. I know, however, how important it is for us theoretical people, who are in constant danger of overlooking technical difficulties and of oversimplifying practical problems. If our teaching in the universities is now sometimes impractical, it was certainly more so before we read this paper of "Student" and heard of the unexpected tricks that might be produced by the repeated analyses, even if they are carried out in seemingly identical conditions.

Whatever "Student" wrote was simple, interesting, important and very well written. I shall always remember his advice how to write papers so as to make them easier to understand: "First say what you are going to say. Then say it. Finally say that you have said it. And then the reader will have no chance of overlooking what you wanted to say." This is a good advice and "Student" was careful to follow it strictly. Unfortunately he was wrong in his last conclusion: the recent literature shows that, even with such precautions as in "Student's" papers, their essential parts may be overlooked or misinterpreted.

With the death of Mr. Gosset theoretical statisticians have lost a teacher of practical problems. Persons interested in various applications of statistics have lost the man who most successfully taught them the theory. Many people, practically all who had the privilege of meeting Mr. Gosset personally, have lost a most cordial, sincere and gentle friend.

J. NEYMAN

* "Student". "On Testing Varieties of Cereals," *Biometrika*, Vol. XV (1923) pp. 271-293

† *Biometrika*, Vol. XIX (1927), pp. 151-176

INTERNATIONAL STATISTICAL INSTITUTE

Professor Robert E. Chaddock and Dr. Halbert L. Dunn are the American members elected to the International Statistical Institute on the most recent ballot. The other American and Canadian members of the Institute are: Honorary—Herbert C. Hoover, Walter F. Willcox; Regular—William L. Austin, R. H. Coats, S. A. Cudmore, Edmund E. Day, Davis R. Dewey, E. Dana Durand, Richard T. Ely, Haven Emerson, Roland P. Falkner, Irving Fisher, Worthington C. Ford, Joseph A. Hill, M. C. MacLean, H. Marshall, Wesley C. Mitchell, Charles P. Neill, William F. Ogburn, Raymond Pearl, Stuart A. Rice, Joseph Schumpeter, Cary Snyder, William M. Steuart, and Edwin B. Wilson.

INSTITUTE OF MATHEMATICAL STATISTICS

The 1937 meeting of the Institute of Mathematical Statistics was held in Indianapolis, Indiana, on December 29–30. The Institute held three sessions, one devoted to voluntary research papers, another to invited addresses on theory, and the third to invited papers on applications of statistics to industry and engineering.

The Institute luncheon was held at the Marott Hotel, at which Professor H. L. Rietz spoke on "The Future of the Institute in Relation to Mathematical Statistics."

At the business meeting the following officers were elected for 1938: President, B. H. Camp; Vice-Presidents, P. R. Rider, and S. S. Wilks; Secretary-Treasurer, A. T. Craig.

The Institute voted to hold its 1938 meeting with the American Statistical Association.

POLISH STATISTICAL SOCIETY

The Society has been established as an organization uniting all persons engaged in the various domains and divisions of science, who are seriously interested in the application of statistical methods. The object of the Society is to develop the science of statistics both in the theoretical and in the practical field. Within the near future the Society will publish a scientific periodical as its organ.

The offices of the Society are situated temporarily in the premises of the Chief Bureau of Statistics of the Republic of Poland, viz., at 32, Al. Jerozolimskie, Warsaw.

The following persons were elected to hold the executive posts within the Society: Mr. Edward Szturm de Sztrem, President; Professor Jan Czekanowski, Vice-President; members of the Executive Committee—the President and the Vice-President as above; Secretary, Mr. Jan Derengowski; Treasurer, Dr. Jan Wiśniewski; Mr. Rajmund Buławski, Mr. Zbigniew Łomnicki, and Mr. Edward Strzelecki.

PROGRESS OF WORK IN THE CENSUS BUREAU

THE CENSUS BILL

At this writing (February 1) the bill prepared in the Bureau of the Census to provide for "the Sixteenth and Subsequent Decennial Censuses and for other purposes" has not yet reached Congress. It has been approved by the Secretary of Commerce, and is being considered and reviewed by the Budget Committee and by the Central Statistical Board.

Under the bill as drafted by the Census Bureau, the decennial census hereafter will regularly cover population, employment and unemployment, housing, agriculture, irrigation, drainage, and horticulture. All these subjects were covered by the census of 1930, except housing.

The bill provides for a quinquennial census of industry and business to cover the year 1943 and every fifth year thereafter. The subject of manufactures will be included in that census and the present biennial census of manufactures will be discontinued. There will, however, be a limited annual census of industry and business for each of the years intervening between the quinquennial censuses. The bill provides also for a census of population to be taken in the year 1945 and every ten years thereafter in connection with the census of agriculture which is provided for in the present law and perpetuated in this bill. That will give us a quinquennial census of population as well as one of agriculture.

The bill gives the Director the authority to compile and publish estimates of population in the interval between census enumerations.

In addition to the quinquennial census there will be a census of industry and business covering the year 1939. This, of course, will be taken in 1940 and the work of collecting and tabulating the data and preparing and publishing the reports will have to be carried on simultaneously with the work on the decennial census. The Sixteenth Decennial Census, therefore, will practically, though not nominally, cover everything included in the Fifteenth Census and more; but that will not be true of decennial censuses after the Sixteenth.

The bill makes provision for the collection of statistical data—monthly, quarterly, semi-annually, or annually—supplemental to the censuses specifically authorized by law, and covering such basic data as production, sales, shipments, orders and stocks of commodities, and the activity and capacity of machinery or plants. The Bureau has long been collecting statistics of this character but on a rather limited scale. The authority conferred by this section of the bill is hedged about with certain qualifications. The Director is authorized to collect such statistics "when directed by the Secretary and within appropriations available therefor;" and such collections may be made "at public expense only in event that the Secretary after due investigation shall find the inquiry necessary to serve a broad public need of an urgent nature."

The Director of the Census is further authorized to make limited annual surveys of agriculture, the scope, content, and procedure of such surveys to

be determined by agreement between the Secretary of Commerce and the Secretary of Agriculture, and the latter to be responsible for the field canvass, while the Director is to tabulate the data and publish the report thereon. Those who know about the so-called Buchanan bill will realize that these are the provisions of that bill, which has now been taken over into the Census bill almost verbatim.

It is to be anticipated that the bill in its progress through the Budget Committee and the Central Statistical Board before it reaches Congress will undergo some changes, the nature and extent of which it is not possible to predict at this time.

THE UNEMPLOYMENT REGISTRATION

The unemployment data recently secured through the Postal Service by a process of voluntary registration are now being tabulated. This work is in charge of a special organization created for the purpose and having no connection with the Bureau of the Census. The Bureau, however, is furnishing the electrical machinery for the tabulation, and has loaned some of its best qualified statisticians and experts to advise and assist in tabulating and publishing the returns.

Following the first announcements of the total registration given to the press early in January, a preliminary report has been published giving the registration by counties and for cities of over 10,000, and distinguishing three classes, namely (1) unemployed and wanting work, (2) employed in W.P.A., N.Y.A., C.C.C., or other emergency work, and (3) partly employed and wanting more work. The card punching is nearly completed and the machine runs, of which there will be four, are under way. The cards sorted by class and sex will be run for age, race, occupational groups, industry, number of dependents, and number of other workers in the family. It is expected that the work will be completed by June 1.

MUNICIPAL REFERENCE SERVICE

During the past year the Bureau has established a Municipal Reference Service in the Division of Financial Statistics of States and Cities. The basis of this is a collection of municipal data from cities with a population exceeding 50,000 now being assembled as a sub-project of the Federal Writer's Project fostered by the Works Progress Administration. The collection consists of data officially compiled as a matter of public record and available in printed, mimeographed, typed, or other form (including newspaper clippings). It covers all the various functions and activities of municipal governments.

The material is being collected in duplicate, one set being permanently retained in the Bureau for reference and use by Government Officials and others in Washington, while the other will be available for loan to city officials and research workers elsewhere.

A CARD INDEX FOR THE CENSUS OF 1920

In previous issues of this JOURNAL references have been made to the card index of the 1900 population census which was being prepared as a W.P.A. project in St Louis. This has now been completed and has proved to be of great assistance to the Census Bureau in meeting the increasing demand for certificates of age required in applications for old-age pensions and in other connections. Formerly the cost of looking up a name in the original census schedules was about \$3.00 but with the card index a name may be located and the information transcribed at a cost of only a few cents. Arrangements have now been made to have a similar index covering the census of 1920. This will be prepared as a W.P.A. project in New York City. Approximately 106,000,000 people were enumerated in the census of 1920; and it has been estimated that it will require the services of about 3,600 persons working for 18 months to complete the index. The clerical force employed on this task will be taken from the local relief rolls, the Bureau of the Census supplying only the supervisory force.

J. A. H.

A CORRECTION

Mr. Benjamin Greenstein calls to my attention the fact that an error in sign has inadvertently crept into Table IB of my article, "On the Simultaneous Determination of the Elementary Regressions and Their Standard Errors in Subsets of Variables" (September, 1937). On page 522, the section beginning "From line 6" should read:

$$P_{22} = \frac{-\Delta_{2344}}{\Delta_{2344}} \cdot P_{23} - \frac{\Delta_{2334}}{\Delta_{2344}} \cdot P_{24} + \frac{1}{\Delta_{2344}}$$

$$P_{12} = \frac{-\Delta_{2344}}{\Delta_{2344}} \cdot P_{13} - \frac{\Delta_{2334}}{\Delta_{2344}} \cdot P_{14} - \frac{r_{12}}{\Delta_{2344}}$$

JACOB L. MOSAK

STATISTICAL NEWS AND NOTES

Dominion Bureau of Statistics, Canada

Census of 1931. With the exception of the special monographs, Volume I which has just been published marks the final stage in the publication of the Census data. This publication is a compendium of the other volumes and also summarizes the important statistical information of previous censuses. The population of Canada is traced back to 1608. Appended to the Volume is a list of available sources of data from all past censuses classified as follows: (1) those published in volumes; (2) those published in bulletins; (3) those in folios in the stacks of the Bureau of Statistics; and (4) those in the stacks of the Dominion Archives.

Seven out of twelve of the monographs have been completed as regards population and are now in process of printing. The subjects covered are: (1) Literacy and School Attendance; (2) Origins and Nativity; (3) Unemployment; (4) Age Distribution; (5) Families and Households; (6) Juvenile Dependents; and (7) Rural and Urban. The remaining five are in various stages of completion.

Quinquennial Census of the Prairie Provinces, 1936. Since the last report was submitted the following bulletins have been issued: October 7th—"Occupations and Industries of Gainfully Occupied"; October 15th—"Report on Agriculture for the Province of Alberta"; October 18th—"Unemployment among Wage-Earners"; November 1st—"Unemployment and Earnings among Wage-Earners on and not on Relief in Cities of 30,000 Population and Over"; and December 1st—"Earnings and Employment among Wage-Earners."

Vital Statistics. The first routine compilation of deaths by the place of residence of the deceased was made for the year 1935 and the report covering this compilation is now complete. The data supplements the tables of deaths by occurrence which appear in the Annual Report of Vital Statistics for the year 1935; they do not replace these tables.

Up to and including the year 1934, the regular compilations of the Vital Statistics of Canada made in the Dominion Bureau of Statistics were tabulated according to the locality in which the birth or death took place, though special tables showed the number of births of non-resident mothers and the number of deaths of non-residents in cities and towns of 5,000 population and over. A special tabulation was made of births and deaths according to place of residence for the years 1930-32, which allowed the computation of standardized rates on the population results of the Census of 1931.

For 1936 both births and deaths have been coded in such a way as to permit of the issue of tables according to place of residence.

Agriculture. The Agricultural Branch of the Dominion Bureau of Statistics has under consideration the use of meteorological data of supplementary crop-correspondent information in the preparation of crop estimates and

condition reports. To date a report on the influence of rainfall and temperature on wheat yields in Saskatchewan has been prepared; it is planned to extend this to the provinces of Manitoba and Alberta.

The Agricultural Branch released a new bulletin "Receipts from the Sale of Principal Farm Products" in January 1938. This publication which gives details of income from farm marketings in the Prairie Provinces will be issued monthly. As work in the other provinces progresses similar information will be made available for them.

Education. Two excerpts from the briefs submitted to the Rowell Commission by the Education Branch of the Dominion Bureau of Statistics and by the Canadian Teachers' Federation, respectively, are of interest:

(1) "Educators throughout Canada are agreed as to the outstanding service of this office (the Education Branch of the Dominion Bureau of Statistics) since its inception. It has to a remarkable degree become the National Bookkeeper of Canadian Education, collecting and analyzing comparative facts dealing with formal and informal education in the Provinces, the cities, the towns, and rural areas of the Dominion . . . this office corresponds in a small way to the United States Office of Education. . . . The services rendered could be greatly extended with advantage to education in Canada by means of publications, conferences called by the director, and by the use of the radio."

(2) "Among its (The Dominion Government's) most important educational activities is the provision of the Education Branch of the Dominion Bureau of Statistics. This Branch is responsible for the publication of the Annual Survey in Canada . . . also a series of bulletins on educational topics. So valuable is the work of this office and so plain has it become that its activities are peculiarly adapted to the Government, that almost all educationists are of the opinion that its scope should be greatly extended."

Central Electric Stations. A statistical survey of the use of electric power in manufacturing and mining industries in 1935 has recently been issued. It is shown that 78 per cent of power equipment capacity in manufacturing industries and 76 per cent in mining industries was made of electric motors operated largely by power purchased from central electric stations. The increase in power equipment since 1923 has been considerably greater than the increase in the number of employees, though the business revival of 1934 and 1935 resulted in a greater increase in employees for those years than of power equipment but still over the long-term period the gap was wide and indications are that it will continue to widen.

International Conference on Population at Paris, 1937. Canada was represented at this conference by M. C. MacLean, Chief of the Census of Analysis Branch of the Dominion Bureau of Statistics. A paper prepared by Mr. MacLean and Mr. A. J. Pelletier, Chief of Demography, dealt with the Canadian economic family (or household). The conclusion drawn from the paper was that the size of the Canadian household has remained fairly constant since the time of the first French settlers.

Central Statistical Board

Standard Industrial Classification. In the past six months important progress has been made toward the establishment of a standard industrial classification for the compilation of statistics. It is hoped that this classification will be generally adopted, thus providing comparability of business data collected by various agencies and increasing their usefulness, thereby making it possible to avoid what now appears to be irreconcilable and conflicting results. In June 1936 the Social Security Board adopted, with slight modification, a two-digit classification of manufacturing and non-manufacturing industrial groups. This classification was developed under the auspices of the Division of Placement and Unemployment Insurance of the Department of Labor and Industry of the State of New York by Mr. Kolesnikoff of the Central Statistical Board's staff, Mr. Solomon Kuznets (then of the Bureau of Labor Statistics), and Mr. Leonard Adams of the New York State Division of Placement and Unemployment Insurance. Later, upon the recommendation of the Social Security Board, other States having unemployment compensation laws adopted the same classification.

The Central Statistical Board has taken the initiative, through an inter-agency committee which it established at the request of the Social Security Board, in proceeding toward the perfection of the two-digit classification and toward the preparation of a detailed subclassification which will be presented in a standard four-digit industrial classification manual. As an aid in the classification of individual enterprises and establishments, the Committee is preparing a list of goods and services produced in the United States, cross-indexed by producing industries.

It is intended that the *Standard Industrial Classification Manual* will consist of three sections, namely, Manufacturing Industries, Non-Manufacturing Industries, and a Cross-Index of Products and Services.

The classification of manufacturing industries (Section No. 1) has been completed and suggestions and comments have been obtained from trade associations and representatives of industry. A number of revisions are contemplated in the classification now being used by the Division of Manufactures in the Bureau of the Census in an effort to improve existing classifications.

Preparation of the section covering non-manufacturing industries is now in progress and comments and suggestions from representatives of industry and trade associations will be sought in the near future. Although some classification systems have been developed for the non-manufacturing field, this field still remains relatively undeveloped. Thus far work on the standard classification has been confined to establishments; the problem of multiple establishments will be considered later.

Preparation of a cross-index of products and services (Section No. 3) will be undertaken in the near future and it is hoped that the *Standard Industrial Classification Manual* will be ready for distribution early in June.

The following agencies are represented on the Committee on Industrial

Classification: Central Statistical Board, Social Security Board, Treasury Department, Bureau of the Census, Securities and Exchange Commission, Bureau of Labor Statistics, U. S. Employment Service, and the Division of Placement and Unemployment Insurance, Department of Labor and Industry of the State of New York.

Board of Governors of the Federal Reserve System

The *Federal Reserve Bulletin* for November 1937 included a tabular analysis of changes in the number of national and State banks during 1921-1936, by States. This analysis covered the factors of increase such as primary organizations, reopenings, etc., and the factors of decrease such as suspensions, conversions, consolidations, mergers, etc. An analysis of bank suspensions supplementing the detailed tabulations of suspensions included in the September 1937 issue of the *Bulletin* appeared in the *Bulletin* for December 1937. An article on group banking in the United States as of December 31, 1936, and another on trends in bank earnings were included in the February 1938 issue of the *Bulletin*. The study of bank earnings is based primarily on national bank data, although attention was given to such other material as is available.

Division of Finance and Research, Farm Credit Administration

The Economics Subdivision in cooperation with the Farm Credit Administration of Springfield and the Maine Agricultural Experiment Station has been engaged in a study of farm credit problems in Aroostook County, Maine. Data have been obtained on the amount of farm mortgage indebtedness and changes in indebtedness in recent years. Sources of short term credit, purpose and costs of short term credit and experience of creditors in financing potato production were important aspects of the study. Records were obtained from individual potato growers and an analysis made of their credit problems.

Studies of land classification and loan experience have been carried on in certain counties of New York, Iowa, North Dakota, Montana, and Maine, in each case in cooperation with the Farm Credit administration of the district and in some cases also in cooperation with agricultural experiment stations. The results of the analysis of loan experience in different land classes indicate that first mortgage farm loan experience was much more favorable on the more productive than on the less productive land.

A study of credit unions is in progress in which the operating experience of nineteen urban and four rural credit unions is being analyzed in detail. The purpose of this study is to develop information on the services, loan policies, administrative practices, and financial problems of credit unions which would be of value to credit unions and supervisory authorities.

Securities and Exchange Commission

The Research Division has initiated a program under which our statistical information about trading in securities on exchanges and in the over-the-

counter market will be considerably enlarged. It is expected that in the course of time part of the statistical information to be collected by the Commission will be made available to the public in one form or another.

The statistics on underwriting activities and related matters were released on November 2 and 29, 1937, in Statistical Series Releases Nos. 30 and 41, respectively. These releases marked the beginning of the more or less regular publication of such statistics which had been accumulated for some time within the Commission. All material has been limited to issues registered under the Securities Act of 1933, and generally only to such of these as amounted to \$1,000,000 or more.

Averages of such underwriting data as gross spreads (commission and discount) to underwriters, concessions to dealers and characteristics of bonds, detailed tabulations of such information by issues, underwriting participations, analyses of the expenses of registration and flotation of securities, and data on securities offered to stockholders by means of rights have been released. The first three items appear to be susceptible to regular publication and it is the intention to release additional data quarterly. Additional statistics on the other items will be released at irregular intervals as the material becomes available; the data published thus far do not cover the period beyond June 30, 1937.

The statistical work in connection with the Commission's study of investment trusts and investment companies has been completed. The submission to Congress of the pertinent sections of the Commission's report is now expected in the Spring.

Federal Trade Commission

On November 16, 1937, the President, in a letter to the Commission, directed it to make an immediate investigation into monopolistic practices and other unwholesome methods of competition to which, it was alleged, a reported marked increase in the cost of living in 1937 was in part attributable. The President directed that report be made as early as practicable. On November 20 the Commission enacted a resolution to undertake this investigation.

It will be noted that the President's letter does not, as has been popularly supposed, direct a general inquiry into the cost of living or into causes generally of any increases thereof, which may have occurred, but only into certain practices which, under the anti-trust acts, are already under the Commission's watchful eye and to which increases in the cost of living may in part be attributable. No report on the progress the Commission has made in the investigation has yet been made.

The Commission's inquiry on farm implements and machinery is under way. Public Resolution No. 130, under which this investigation is being made, directs the Commission to investigate corporations "engaged in the manufacture, sale or distribution of agricultural implements and machinery of whatever kind and description" Among other things, the Commission is required to ascertain costs, selling prices, profits, and distribution

methods of both manufacturers and distributors. Conditions of competition, tendencies to monopoly, and apparent violations of the anti-trust laws are to be ascertained and reported.

Report forms have been sent to some 250 manufacturers, more than 6,000 independent retail dealers, 250 retail dealers affiliated with manufacturers and almost 16,000 representative farmers and farm leaders.

An engineering study is being made to cover manufacturing methods, changes in designs, improvements in the quality of machines, and other engineering problems.

Bureau of Foreign and Domestic Commerce

Monthly estimates of income payments in the United States have been prepared by the National Income Section of the Division of Economic Research, Bureau of Foreign and Domestic Commerce, and figures for each month from January 1929 to December 1937, inclusive, appeared in the February 1938 issue of the *Survey of Current Business*. The estimates were described in an article entitled "Monthly Estimates of Income Payments in the United States, 1929-37," by Robert R. Nathan and Frederick M. Cone.

Figures are presented separately for three major type-of-payment classifications, namely, compensation of employees, aggregate dividends, and interest, and total entrepreneurial income which includes entrepreneurial withdrawals and net rents and royalties. Also labor income is shown separately for four industrial groups, including manufacturing, mining and construction; transportation and public utilities; trade and finance; and Government, service and other industries. Seasonally adjusted indexes have been prepared of total income payment, total compensation of employees, the latter class being broken down into the major industrial divisions. The article discusses the significance of the results and briefly outlines the sources and methods of estimation. The Department plans to publish a bulletin within the next few months outlining in detail the derivation of the estimates for each type of payment and each industry.

The final report on "Consumer Use of Selected Goods and Services, by Income Classes, by Cities" on the fifty cities studied has now been completed and published by the Bureau. The results of these studies reveal characteristic differences in living standards among the various income classes. They not only present a vast array of factual data designed for the use of business men in better covering and better serving the consumer but also include much data of potential interest to consumer groups and individuals. For example, it is noted that families having incomes below \$2,000 constitute the owners of not less than 60 per cent of all automobiles and 40 per cent of all mechanical refrigerators, as reported by a representative sample of each city's whole family population.

Plans are being made for the 1938 edition of the *Consumer Market Data Handbook*, designed as a nation-wide survey of the market for consumer goods. The latest available figures will be shown on a comparable county basis for all counties. This *Handbook*, when completed, should be of great

value to advertisers, marketing executives, and statisticians interested in this type of basic data

The Bureau through the Market Data Section has undertaken the collection and analysis of data on dollar sales, volume of accounts receivable outstanding, and the volume of collections on accounts receivable for both manufacturers and wholesalers. In addition there will be shown each month data on the cost of stocks held by wholesalers. It is believed that the additional data on stocks and credit conditions will serve to give a more complete picture of current domestic production and distribution. The first release of this new series was issued in December.

The Market Data Section has also started its Retail Credit Survey for 1937 which will include for the first time an analysis of installment sales by kinds of business made during the same year. In view of the serious thought given to this subject by economists, business men, and Government officials, this report should be very timely. The results of this study should cast much light on a subject where basic statistical data are meager.

The Survey, which covers fourteen lines of retail trade in eighty-eight cities well distributed throughout the country, will point out significant credit facts regarding each kind of business studied, cost and credit sales, collection percentages and bad-debt losses. In addition, it will include many charts and tables which should be of great value to students of credit selling. Publication of this volume is expected to take place sometime about the middle of this year.

Total retail and wholesale trade estimates for 1937 were released during January. These estimates are by kinds of business and describe the activities that took place in these fields of distribution during the past year.

The Division of Foreign Trade Statistics will release shortly data on foreign trade statistics for 1936, as well as statistics of foreign commerce and navigation for the same year.

The Bureau of Foreign and Domestic Commerce has recently released their revised and enlarged edition of the check sheets for the introduction of new industrial products which first appeared in June, 1935. This revised volume includes a preface on the place of marketing research in present day industrial markets which discusses the need of a marketing research department by manufacturers and an analysis of causes why such departments have failed in many firms in the past. There is also included a seven page bibliography of Government sources of industrial market research material, as well as two check sheets, one being devoted to direct marketing problems, and one concerning the origination and production of a new industrial product.

Marketing men engaged in foreign trade and teachers of this subject will be interested in the forthcoming volume on export and import practices which will be available early in 1938. This publication discusses step by step the export and import practices in the United States today. The first part of the volume is devoted to export practices and shows why and how the market abroad for any products should be analyzed, both as to the possibilities

for its sale and the existing agencies of distribution. The technique of export selling and the handling of competition in foreign markets, trade restrictions abroad, packing, documentation, transportation, methods of protecting patent and trade marks from infringement and financing of the export shipment, are also discussed and explained. The second part is devoted to import practices and deals with methods of analyzing home markets; the accepted agencies used in purchasing abroad; the importance of credit position; methods of purchasing various types of imported commodities; United States Customs procedure and formalities; and financing of imports. This volume contains much additional information which will be of value to both importers and exporters. A liberal use of forms illustrates the text, and a very complete appendix, as well as a glossary of commercial abbreviations are also presented.

Another volume of interest to marketing men is the recent Bureau publication on "Advertising in Brazil." In this volume is presented a detailed, up-to-date analysis of this country as a market for imported merchandise. The text and tables contained in this volume are well written and give the reader a comprehensive picture of this market.

The Economic Research Division of the Bureau will release shortly its publication on preliminary data on Construction Activity in the United States from 1915 to 1936. This investigation is primarily a compilation of statistical data showing the volume of construction activity in the United States over the period indicated above. Such data are shown by types of uses or function, such as residential, water supply, and highway construction; and by types of ownership such as public utilities, Federal, state, and local government activity. This forthcoming report will also include some statistics for early years and a brief analytical discussion of the fluctuations in construction activity. Another item of important interest included in this study will be an index of total construction activity from 1900 to date. A discussion of trends and fluctuations of construction and comparisons made with other lines of economic activities is also presented. This study also shows the development of logical classifications of construction activity, a summary of the statistics, and a brief discussion of the characteristics of the industry. Detailed explanations of the methods which have been used in arriving at the estimates are given in the several chapters of part 2.

The article in the December issue, of the *Survey of Current Business*, "Survey of Family Income," is based on preliminary data released by the Bureau of Labor Statistics and the Bureau of Home Economics. This article deals with the incomes of our native-white families and shows how they vary from one community of the country to another. Of the 152,000 families on which preliminary data have been released, the proportion which have been on relief at some time during the schedule year varied considerably from city to city and village to village. Forty-four per cent of the non-relief families surveyed owned their own homes with home ownership being relatively greater among the families reporting higher incomes. The highest percentage of home ownership was reported by families surveyed in villages.

United States Tariff Commission

The Works Progress Administration Statistical Project at Richmond, Virginia, conducted under the supervision of the United States Tariff Commission was described in the June 1936 number of this JOURNAL. Most of the work undertaken in this project has been designed to provide more detailed information and more nearly comparable data for a number of years regarding United States imports than is available in *Foreign Commerce and Navigation of the United States* published by the Department of Commerce. The original program has been extended through December of this year, and all of the work planned at present will be completed by that time. As a result of this project, there are now available for distribution the following tabulations:

United States imports for consumption by countries during 1929. This tabulation shows imports for consumption into the United States by countries for approximately 4,500 commodity classes in numerical sequence within the commodity groups, according to the statistical arrangement used by the Department of Commerce. This arrangement is similar to the volumes furnishing 1931-35 and 1936 import statistics discussed in this JOURNAL (June 1936).

Computed duties and equivalent ad valorem rates on imports into the United States from principal countries during 1929, 1931 and 1935. This report shows the average rates of duty on free and dutiable imports from 34 selected countries, the data arranged by commodity groups. In addition, detailed statistics are furnished for principal commodities imported from 11 of these countries.

Schedule A—Statistical classification of imports to the United States arranged by tariff schedules and tariff paragraphs of the act of 1930, effective January 1, 1937. This tabulation presents a rearrangement by tariff paragraphs of Schedule A Statistical Classification of Imports into the United States. The basic material from which this compilation was made was taken from the statistical classification effective January 1, 1937, issued by the Bureau of Foreign and Domestic Commerce, which is arranged by the commodity groups used by the Department of Commerce in the publication of its import statistics. Authorized changes through April 9, 1937, have been incorporated. This compilation also includes pertinent information and detailed instructions for use in interpreting coded statistical material prepared by the Department of Commerce. A supplement to this volume is being prepared, listing the items which have been specified in the reciprocal trade agreements now in effect.

Monthly imports for consumption into the United States by economic groups, agricultural and non-agricultural, during 1932 and 1933. This report furnishes data regarding free and dutiable imports for 48 selected countries comparable to the summary figures published in *Foreign Commerce and Navigation of the United States* for 1935 (Table 24).

Reciprocal trade bibliography. This compilation affords current data by abstracting references from the congressional records and adding other new entries since the publication of *The Tariff*, a bibliography issued during 1934.

Commodity packaging and density-stowage study. This study represents an analysis of the packaging of approximately 2,000 commodities, and furnishes data showing the density and stowage factors of the commodities named in the Tariff Act of 1930, which are important in domestic and international trade. This material has been arranged in convenient form for ready use in matters of transportation, and will be issued as a handbook in the near future.

Reports on chemical nitrogen, sodium sulphate or salt cake, flat glass, and wood pulp and pulpwood have recently been issued by the United States Tariff Commission. These reports contain comprehensive analyses of industry and trade in the commodities with which they deal, and all are of interest in connection with current developments in international trade. The reports are based in part on official statistics, but also in part upon original data collected by the Commission.

Bureau of Labor Statistics, U. S. Department of Labor

Surveys of wages, hours, and working conditions are under way in a number of industries. The bituminous coal study will appear shortly in bulletin form and the survey of the cotton goods industry is nearing completion. Field work has been completed for the radio and electrical manufacturing and appliance industries. Surveys have recently been undertaken for the meat packing plants; explosives, ammunition, and fireworks; and furniture manufacturing, to cover household furniture, wood and metal office furniture, and public seating. Some 80,000 firms in both manufacturing and non-manufacturing industries have been questioned with regard to their vacation policy, and the replies to this inquiry are in process of being analyzed.

The Bureau's annual survey of industrial injuries in 30 manufacturing industries for 1936 as compared with 1935 has been completed. The detailed analysis of industrial injuries which is made each year for the iron and steel industry is also ready for distribution. A special study has been made of causes of injuries in the fertilizer industry.

An article has been published on the amount of labor created by expenditures on PWA construction projects during the four years from the beginning of the program in July 1933 through June 1937. The study treats of both the amount of labor at the site and the estimated indirect labor created.

The surveys of labor productivity made by the Bureau of Labor Statistics in cooperation with the National Research Project of the WPA for cigars, cotton garments, and leather have been completed. In the field of labor legislation two new bulletins have been published—"Occupational Disease Legislation in the United States, 1937" and "Laws Relating to Employment Agencies in the United States." The latter study covers legislation in effect in 1936 with an appendix for 1937 and deals with both public and private agencies, including immigrant agencies.

Information on union wage rates and hours, as of May 15, 1937, has appeared in recent issues of the *Monthly Labor Review* for the building trades,

the printing trades, street railways, bakeries, and truck driving. The annual report on strikes in 1937 is in preparation.

From January 10 to 28, a conference of the Bureau's retail price field agents was held in New York. The conference was devoted to general problems in field work, and this year special attention was given to the pricing of textiles and clothing. Members of the Bureau staff, representatives of the textile industry, and authorities on marketing and pricing problems addressed the meetings, and considerable time was given to round table discussion.

There is available a new series of indexes of net monthly bills for electricity, from March 1923 to December 1937 for each of the 51 cities from which electricity prices are secured. The indexes are for 3 of the 4 services for which prices are regularly published quarterly—25 and 40 kilowatt-hours for lighting and small appliances and 100 kilowatt-hours covering also the use of a refrigerator.

The Bureau is releasing each quarter mimeographed tables showing retail prices of coal and other fuels in the 51 cities included in the retail price series. These data are given for kinds, grades, and sizes of the fuels which are most important for household heating in each city, and are presented in greater detail than those which have appeared in published reports.

The Bureau is engaged in reviewing its rental sample in each of the 32 cities included in its cost of living indexes in an attempt to make the sample representative as to types of dwellings, rents paid, geographical distribution, etc. Indexes by types of dwellings from 1935 to date (1935 average = 100), based on rentals paid for unfurnished, occupied dwelling units, have been released for 13 cities in which a revised sample has been obtained.

With the calculation of the weekly index number of wholesale prices for January 1938, the Bureau introduced the revised method of computation which was introduced in the calculation of the monthly indexes in July 1937. Discussion of the revised method of calculation appeared in the December 1937 issue of this JOURNAL. Copies of a reprint of the article are available from the Bureau of Labor Statistics.

During the past two years the Wholesale Price Division of the Bureau has been engaged in a program for the improvement and betterment of its wholesale price reporting service. Surveys have been completed for the improvement of the wholesale price reports for the cement, soap, and farm machinery industries. The revised prices and index numbers for these industries were incorporated in the calculation of the Bureau's general index number beginning with the computation of the index for January 1938. The revised data for other industries and items being surveyed will be incorporated in the computations at regular intervals. Among these which are scheduled for completion early in 1938 are lumber and millwork, brick, shoes and other leather products, automobile tires and other rubber products, chemicals, insulation and wall board, tile, fiber board, and small implements and tools.

Early in 1938 the Bureau plans to revise the report "Specifications of Commodities Entering into the Composite Weighted Index" issued in Sep-

tember 1935. In collaboration with the Research and Statistics Division of the Office of the Secretary of the Treasury Department, there was prepared late in 1935 an index of 189 most sensitive commodities and 190 least sensitive commodities. A copy of the list of commodities entering each group and the indexes from January 1928 forward together with a chart showing the movement of the indexes are available from the Bureau.

The records of more than 20,000 registrants at selected Public Employment Offices who had migrated across State lines have been made available to the Bureau of Labor Statistics by the United States Employment Service. Partial tabulations of these data were included in the preliminary report of the Secretary of Labor to the Senate on the subject of migration of workers. These data have been punched on Hollerith cards and a full analysis will be made by the Bureau as funds are made available.

Social Security Board

The end of 1937 marked the completion of the first full year of operation of the old-age insurance program. Statistics of the operations indicate the extent to which the program has been established and gotten under way. At the end of December 1937, the number of applications for employee account numbers had reached the total of 36,688,339. Total pay-roll taxes collected under Title VIII from employers and employees, as of the same date, amounted to \$506,180,184 according to Bureau of Internal Revenue figures. Wage reports covering the first half of 1937 are now being posted to individual employee wage records in Baltimore, and reports for the second half of 1937 are being received currently from employers. The new regulations providing for employers' quarterly reports of taxes and individual employee earnings on a single form will go into effect in 1938. A cumulative total of 69,771 claims for lump-sum benefits had been received by December 31, of which 50.6 per cent were claims for death payments and the remainder for lump-sum benefits at age 65. As of the same date, 53,237 claims had been certified for payment in a total amount of \$1,277,516.

There has been created in the Bureau of Old-Age Insurance of the Social Security Board a new Analysis Division under the direction of Merrill G. Murray, formerly Associate Director of the Bureau of Unemployment Compensation. This Division will conduct administrative research and studies in the field of old-age insurance and perform the actuarial operations necessary to the work of this Bureau. In addition to these functions, it has been charged with the responsibility of preparing the statistics emanating from the old-age insurance program. The Analysis Division, in collaboration with the Division of Old-Age Benefits Research in the Bureau of Research and Statistics, is continuing analysis of the 11-million sample of applications for account numbers under the old-age insurance program to which reference was made in the September issue of this JOURNAL.

Bureau of Research and Statistics, Division of Public Assistance Research. Publication of *Relief in Urban Areas*, which was suspended with the issue covering the month of May 1937 to permit a thorough reexamination of the

reports included in the series, was resumed in January. Reports for the months of June through September, as well as a revised trend including earnings under the Civil Works program and earnings of persons certified as in need of relief employed on WPA projects, appeared in this issue.

General Relief Statistics: At the request of the Senate Committee to Investigate Unemployment and Relief, the Division, on January 5, requested telegraphic reports covering the month of December from selected cities on the number of cases receiving general relief, the number of cases added during the month, and the number of general relief cases with "employable" persons. The same data were requested from state agencies for entire states in order to corroborate city reports. State agencies have been requested to continue to submit telegraphic reports on these items by the seventh of each month for selected urban areas in addition to the regular monthly reports. Hitherto, state totals for general relief have been published for states submitting substantially complete reports; estimates for all states from which inadequate and incomplete reports are currently received will be published in the February issue of *Public Assistance: Monthly Statistics for the United States*.

Relief in Urban Areas: Following completion of the revision of figures included in the trend of urban relief in the United States, figures from each city are being rechecked to discover errors which seriously affect the trend for an individual area but do not appreciably affect the United States total. This is being undertaken because of the numerous requests for tabulations for particular areas.

Old-Age Assistance Program: A special study of the old-age assistance program in urban areas and in rural areas in November 1937, based on reports received for the urban and rural series, has been initiated. The number of recipients and the amount of obligations incurred for payments will be related to the population. Average payments per recipient in rural and in urban areas also will be compared.

Public Assistance 1933-37: Tables showing the distribution by states of obligations incurred for payments to recipients of old-age assistance, aid to dependent children, and aid to the blind, by six-month periods, are in progress; figures for the United States were published in January. Data on old-age assistance and aid to the blind programs for the years prior to 1936 are based on reports published by the U. S. Department of Labor. All other data were collected by the Division from state and local agencies.

Bureau of Research and Statistics, Division of Unemployment Compensation Research. The final forms and instructions on the reporting of benefit statistics were issued to the states in January. The forms provided for the reporting of claims received, disposed of, appealed, and payable; the number and amount of benefit payments for total and partial unemployment, classified according to the amount of the payment; the promptness of payment; the placement of claimants; and the number of claims received by local employment offices. Other forms noted in previous accounts of activities are being held in abeyance, pending clarification of benefit paying procedures in the states. First reports from 22 states and the District of Columbia,

in which benefits were payable in January, will cover operations for that month.

The Division has been developing techniques for the conduct of studies of seasonal unemployment, partial unemployment and part-time work, and factors affecting qualifications for benefits. A memorandum has been prepared on merit rating in unemployment compensation.

*Division of Research, Statistics and Records,
Works Progress Administration*

Works Program Statistics. Effective with the completion of reports for November 1937, the function of compiling statistics on the operations of the Works Progress Administration was transferred from the Area Statistical Offices to the several State Works Progress Administrations. The need for reducing operating costs to a minimum made it necessary to curtail the scope of statistical reporting. At the same time, it was believed that many of the past obstacles in the way of an adequate state reporting system have been gradually eliminated, thereby making it appear practicable to place the responsibility for a minimum number of essential statistical reports in the states. The transfer thus results in further organizational simplification.

Under the new procedure, as in the past, the WPA reporting system will be under the general supervision of the Division of Research, Statistics and Records in Washington. Reports will be compiled in the states from the operating documents and records prepared and maintained by the various operating divisions. Wherever possible, the mass tabulation work will also be carried out in the operating divisions. A State Statistician, whose appointment is approved by the Washington Office, is responsible in each state for the technical accuracy and submission of all statistical reports and will act in liaison capacity between the state and the WPA Division of Research, Statistics and Records in Washington on matters pertaining to reporting. A Regional Statistician, representing the Division in the field, also has been appointed to each of the five WPA Regional Offices to work with the State Statisticians and the heads of the various state operating divisions on technical procedures for regular reports and special tabulations supplementing the regular reports which may be required by the Washington or the Regional Offices.

The principal reports now required or planned under the new system are a weekly count of the total number of persons under active assignment to work projects in each state; a quarterly report on employment by county of project operation for the last week in each quarter; a similar quarterly report of employment by type of project; a monthly report on sponsors' expenditures for WPA projects for labor and non-labor costs; a monthly report on hours worked and earnings on WPA work projects for each state and for selected urban areas; a monthly report on sponsors' expenditures for NYA projects for labor and non-labor costs; a monthly report on employment, hours worked, and earnings on the NYA Student Aid program by types of

student aid; a monthly report on employment, hours worked, and earnings on NYA work projects; a quarterly report on encumbrances and expenditures for work projects by county of project operation, sources of funds and objects of expenditure; and a quarterly report on encumbrances and expenditures by types of project, sources of funds, and objects of expenditure.

A state reporting system was used under the CWA and FERA programs which preceded the Federal Works Program. The Area Statistical Offices, as established in July 1935 when the Works Program was being put into operation, had three major purposes: (1) the elimination of certain difficulties in statistical reporting that had characterized the CWA and FERA reports which were prepared in state offices; (2) the collection of more extensive and more detailed information than was found practicable under a state reporting system; and (3) the insurance of coverage of the activities of Federal agencies other than WPA, operating with funds appropriated by the Emergency Relief Appropriation Act of 1935 and subsequent acts.

At the present time the operating procedures and basic records in the State Works Progress Administrations are fairly well standardized. Hence, greater comparability is found from state to state than characterized the previous ERA and CWA programs. Likewise, the records are maintained on a sufficiently current basis to permit the prompt submission of regular reports. These factors, together with the general experience acquired through more than two years of operation should contribute to the success of the new system and assure a definite advance over the state reporting system of the earlier relief programs.

A comprehensive inventory of physical accomplishments on WPA and NYA projects through October 1, 1937, has been completed. A preliminary summary now available provides national totals. These will subsequently be analyzed by states to show in detail for each state what has been done through WPA and NYA project operations.

Arrangements have been made to conduct several research studies involving analyses of records maintained in the Area Statistical Offices prior to their discontinuance. These include a tabulation of the total number of different persons employed from the beginning of operation through November 1937, the occupations at which WPA workers were assigned to projects, the duration of the employment of workers under WPA, and other aspects of WPA operations that are not available from regular employment and project records. In addition, a study of the NYA students and their family backgrounds is being made from the applications of youths seeking to obtain benefits under the Student Aid program. This analysis covers such items as the occupation of parents, the economic status of the applicant's family, and the age, school grade, sex, and race of the applicant.

Relief Statistics. A summary of general relief statistics for the period January 1936 through March 1937 has recently been issued. The beginning of this period roughly coincides with the termination of Federal Emergency Relief Administration grants to the states, and the return of general relief

responsibilities to state and local governments. Since March 1937, the Social Security Board has been responsible for the collection and publication of general relief statistics.

This summary presents, in addition to revised totals reported by the various states, data for individual cities which have not been published heretofore. The figures are described and explained in accompanying text.

Since the publication of the last issue of this JOURNAL, detailed tabulations of Emergency Work Relief Program costs, by types of project and sources of funds was released for six states and a preliminary summary for the continental United States was completed. Any of these publications may be obtained from the Works Progress Administration upon request.

Division of Social Research, Works Progress Administration

Separations Study. A preliminary report has recently been issued on a November survey of workers separated from WPA employment within the period April through July 1937, in five urban and four rural areas. Data were presented on the sources and amounts of income secured after separation and on the relative economic welfare of the separated cases before and after leaving the Works Program. Also, the post-separation adjustments of these cases were contrasted with those of cases covered in a similar separations survey made a year earlier.

Labor Shortage Studies. The final results of the check-up studies made in the early fall of 1937 on reported industrial and cotton harvesting labor shortages are now available. The industrial studies, which covered 24 large cities, in addition to the urban areas generally in a few other states, revealed that the labor shortage problem was less serious in 1937 than in 1936 and that Works Program employment played little or no part in producing what shortages existed. The cotton harvesting studies, conducted in Texas and several southeastern cotton states, showed that shortages of pickers were localized and temporary and that the supply of cotton pickers was, with minor exceptions, entirely adequate.

Migrant Families. A study of migrant families, who follow casual occupations, has been begun in Arizona and California. Earnings, hours worked, and other conditions of work of this type of family are being covered.

Transient Studies. The yearly check-up on the condition of transients throughout the country has been completed in five cities. The survey indicates that the problem of transiency is at least as severe this winter as it was last winter, and is perhaps more severe. The cities surveyed thus far are Chicago, Jacksonville, Los Angeles, Memphis, and New Orleans.

Digests of State and Local WPA Studies. For some months there have been in preparation digests of state and local research projects carried on with WPA funds. The work of digesting these reports is rapidly approaching completion and it is planned to publish the results in one or more volumes in the next few months. Publication of the digests will make available to students

the major findings of the great number of WPA local research projects conducted during the last few years.

As a separate project the series of state bulletins published under the WPA cooperative plan for rural research is being digested. This series now includes more than 100 reports. The digests are now nearly completed and the material is being assembled for a summary report on the plan.

Relief in Urban and Rural-Town Areas, 1932-1936. This study presents a combination of the data from the urban and rural relief reporting series, estimated up to United States totals. The estimates cover aid to the aged, to dependent children, and to the blind, worked out in cooperation with the Division of Public Assistance Statistics of the Social Security Board; general and veterans' assistance, including local poor relief and hospitalization; Resettlement emergency grants; and private assistance. Wage assistance data are now being revised to include the latest information available.

Survey of Public Assistance Extended to Households in Drought Areas. A field study of relief statistics from 64 sample counties in the Great Plains region is in process of tabulation. The data give complete coverage of relief households for the six-month period, July through December 1936, and include a record of relief household income by months and by agency as well as the usual sociological data. Hand tabulations have been made to show various types of relief duplication.

Study of Rural Problem and Non-Problem Areas. The indexes of social and economic conditions described in this JOURNAL's December notes have been gathered for each county. Both rural-farm and rural-nonfarm areas of relative homogeneity with respect to problems relating to relief and security programs will be established. Actual demarcation of rural farm areas is now under way.

Project Procedures. The Division of Social Research is working cooperatively with other divisions within WPA and with other Federal agencies in preparation of standardized procedures for WPA projects in the field of planning and housing. A comprehensive survey procedure covering real estate activities, originally prepared by the Federal Housing Administration, has been reworked to make the procedures more adaptable to WPA project requirements. Summaries are being made of real property inventory data for all cities which were covered in the Department of Commerce survey of 1934, and in all subsequent surveys. A procedure is also being developed for follow-up sample studies (of occupancy and vacancy) in those cities in which real property inventories have been taken.

Other procedures of this type being developed include property identification maps, use of city directories or similar local records to show the relation of occupancy and vacancy to type of dwelling unit, indexing of mortgages and deeds, and real property valuation and assessment.

Releases of the WPA Division of Social Research. Rural Youth on Relief, Research Monograph XI, by Bruce L. Melvin, is an analysis of the characteristics of rural youth receiving assistance under the general relief program

and a survey of the Federal agencies created to aid underprivileged youth. The monograph analyzes particularly the situation of youth in rural relief families in October 1935 before the Works Progress Administration with its National Youth Administration became really effective.

Trends in Relief Expenditures, 1910-1935, by Anne E. Geddes, is a study planned to give perspective to recent relief developments by relating them to long-time trends. In the report are collected, for the first time, the scattered and fragmentary data on outdoor relief expenditures prior to the recent depression. Taken together, they offer convincing evidence of a strong underlying upward trend in expenditures for at least two decades before the precipitous rise beginning in 1930, and a gradual shifting of the relief burden from private to public resources long before the period of Federal participation in unemployment relief.

United States Employment Service

At the time this note is written the Division of Standards and Research of the Employment Service is preparing material for a new publication covering operations of the Employment Service through December and comparing information secured through an inventory of all registered job-seekers made in November with available results of the National Unemployment Census. This study will carry forward results of earlier studies which have been published by the Employment Service from time to time, the most recent publication being *Survey of Employment Service Information, 1937*.

In addition to giving summary data concerning the volume and character of Employment Service operations throughout the country, the information secured through the Employment Service provides a large-scale sample indicator of the unemployed group. Unlike most other indicators, Employment Service reports contain detailed information concerning such items as age, industrial background, occupational classification, sex, color, education, etc., and gives geographic breakdowns to units as fine as individual counties. Reports are based upon classifications made by trained interviewers at the time of the applicant's original registration and maintained on a current basis through successive reinterviews. Studies¹ conducted by the Employment Service have shown a correspondence between movements of Employment Service series and the movements of various business and unemployment series.

In the past detailed inventory surveys of all active job-seekers have been made at periodic intervals. Work is in progress to determine a sampling method whereby it will be possible to secure a reflection of the characteristics of the registered job-seekers on a national scale at more frequent intervals without the necessity for taking a complete survey in every locality. The characteristics which are being considered in developing sampling bases include age, color, race, sex, and occupational classification of gainful workers and their distribution among industrial groups, as well as their

¹ See "Recent Trends in Unemployment," *Monthly Labor Review*, Bureau of Labor Statistics, United States Department of Labor, November, 1937, pp. 1093-1109.

geographic distribution. The technique being used is one based on the assumptions ordinarily used in correlation analysis. Experience has shown that distributions obtained through the application of this sampling method in general have possessed a high degree of reliability as compared with the complete surveys.

The Worker Analysis Section of the Employment Service is continuing the development of techniques for the selection of inexperienced applicants likely to be successful in particular occupations. Such selective devices for the occupations of coding and card punch operating have been developed. A preliminary procedure for the classification of individuals as department store salespersons has been standardized. Several follow-up studies involving the use of this procedure are now in progress. Work has been started on the standardization of selection and classification techniques for comptometer operating, adding machine operating, calculating machine operating, business machine operating, hand transcribing, and power sewing machine operating.

Office of Education

The bound volume of the *Biennial Survey of Education, 1932-34*, is now on the shelves of the libraries. Previously only the separate "Advance pages" have been available. Bound volumes are not available to the public, but the separate chapters may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

All the statistical chapters except one for Volume II of the *Biennial Survey of Education, 1934-36*, are finished and are or will be soon in process of printing. Certain preliminary data from "Statistics of State School Systems" and "Statistics of City School Systems" have been released and are available from the Office of Education.

The National Archives

The Third Annual Report of the Archivist of the United States was published in January. Included in this report is a 58 page "Guide to the Material in The National Archives." Copies of the report may be had from the Administrative Secretary of the National Archives, Washington, D.C., as long as the supply lasts.

Graduate School of the U. S. Department of Agriculture

Under the title "Lectures and Conferences on Mathematical Statistics" the Graduate School has published the lectures delivered by Dr. Jerzy Neyman and the proceedings of the conferences in which he participated during his visit to Washington in April 1937. The publication has been carefully revised and supplemented by Dr. Neyman with the editorial assistance of Dr. W. Edwards Deming. It includes lectures on the theory of probability, experimentation, and testing statistical hypotheses. The conferences covered a wide range of statistical problems in agricultural and economic research. The book consists of 160 pages mimeographed with a paper binding and

may be secured from the Graduate School of the Department of Agriculture, Washington, D. C., at \$1.25 a copy.

United States Public Health Service

Results of the National Health Survey conducted in 84 cities and 23 rural counties by the United States Public Health Service during 1935-1936, with the aid of Works Progress Administration grants are being issued in two series of bulletins.

An introductory bulletin describes in detail the purpose, scope, and method of the study. The data pertaining to health are presented in the *Sickness and Medical Care Series* reports. They cover prevalence and incidence of acute and chronic disabling illness and the receipt of medical care in relation to factors such as income, relief status, employment status, occupation; age, sex and color; and the amount of time lost from usual activities. A separate sequence of bulletins, the *Population Series*, give population and economic data which are of interest apart from the material dealing with sickness and medical care.

Members of the Association who wish to receive these bulletins should make their requests promptly for there is only a small supply for distribution. Communications requesting bulletins and specifying the series desired should be addressed to the National Health Survey, United States Public Health Service, Washington, D. C.

New York State Department of Social Welfare

On July 14 the Bureau of Research and Statistics of the New York State Department of Social Welfare released the first copy of its new bulletin, "Social Statistics," covering July, August, and September, 1937. Although this issue is concerned chiefly with statistics of public assistance, the title of the periodical promises a broadening scope in the future. Besides presenting and interpreting current statistics, each number will contain a featured article of special interest. The next issue, dealing with the last quarter of 1937, will be off the press about March 1st. Thereafter, until it becomes feasible to publish on a monthly basis, the quarterly numbers will be supplemented by interim releases in mimeographed form.

Brookings Institution

Two Institute of Economics books were published during February.

The Income Structure in the United States, by Dr. Maurice Leven, attempts to clarify the meaning of national income and the distribution of income. It analyzes the factors determining income and in calling attention to the causes of inequalities in income and of poverty it offers a basis for an intelligent approach to the application of remedies.

America's Stake in International Investments, by Dr. Cleona Lewis, tells the story of capital migration to and from the United States from the Revolutionary War period to the present time, gives a comparison of foreign debts and investments at eight significant dates (together with a presenta-

tion and discussion of the basic data employed), and considers the issues involved for the future.

A study to be called "Government in Relation to Industry" is in progress at the Institution under the direction of Dr. Leverett S. Lyon. This study is comprehensive in its scope, including both those phases of economic life which are organized by private enterprise and those which government operates directly. The study, which was begun in the autumn, will be concluded sometime in 1939.

National Bureau of Economic Research

Frederick R. Macaulay's eagerly awaited volume, *Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States since 1856*, was published in February. At first glance, this book, with its eighteenth century title, might seem to be of interest to the purest of the pure theorists alone. But as one begins to read even the highly theoretical first chapter one soon begins to realize that this is the type of theory that is "theory" not because it is impractical but because it really explains. Wesley Clair Mitchell, to whom the book is appropriately dedicated, has written a Preface.

The two volumes by Simon Kuznets, mentioned in the December issue of this JOURNAL, have also been published: *National Income and Capital Formation, 1919-1935* and *Commodity Flow and Capital Formation, 1919-1935*. The former summarizes three National Bureau studies: national income, capital formation, and capital consumption. The latter presents complete and detailed estimates of the volume of capital formation and of the flow of commodities to consumers, as well as the technique used in making the estimates. It includes exhaustive analyses of subsidiary material, e.g., data on distributive margins, inventories, and construction estimates. (The National Bureau has adopted a larger format, $8\frac{1}{4}$ by $11\frac{3}{4}$ inches, for books such as these that contain many large tables.)

The report on *Capital Consumption* by Solomon Fabricant is in the hands of the Directors of the National Bureau and, subject to their approval, will be published by early summer.

The Report of the Committee on Prices in the Bituminous Coal Industry, of which Waldo F. Fisher is Chairman, has been approved by the Directors of the National Bureau. It is one of six reports prepared for the Conference on Price Research. A few copies will be bound in paper for immediate distribution; the rest of the edition will be held until other of the reports on prices in industries are ready and then bound with them in cloth.

As at the 1936 annual meetings of the American Economic and Statistical Associations, the Conference on Research in Income and Wealth, of which Simon Kuznets is Chairman, presented papers at Atlantic City at the December 1937 meetings. These, together with those presented at the annual meeting of the Conference itself, will constitute Volume II of *Studies in Income and Wealth*.

The first *Bulletin* of the 1938 series, number 69, is by W. C. Mitchell: "The Timing of Cyclical Movements in Economic Series."

National Industrial Conference Board

In accordance with its practice of studying different phases of business development, and, in particular, industrial management by means of the sampling method the Board has recently established a new series of publications entitled *Studies in Personnel Policy*. The issues in this series thus far published relate to dismissal compensations, profit-sharing and other supplementary-compensation plans covering wage earners, multiple shift operation, personnel policies affecting salesmen and curtailment, lay-off policy and security. The analysis is by number of companies and when applicable by the number of persons affected. Further studies are projected relating to managerial profit-sharing, company public relations, and employee rating systems.

Parallel in method, but in a somewhat different field, is a study of "Prevailing Practices in Inventory Valuation," now in press and to be issued shortly as the first of a series of *Studies in Administration Control*.

In the field of wages, hours, and employment in manufacturing industries, the regular monthly studies of the Board have recently been supplemented by an investigation of wage differentials. For five leading industries average earnings of all wage earners and of specific occupations are being studied in different sections of the United States. A preliminary report on all male wage earners has been issued as a supplement to the *Conference Board Service Letter* (January 1938). Preparations are being made for a comprehensive study of clerical salaries early in the spring.

The Conference Board will issue shortly a new study, by Dr. R. F. Martin, on national income covering briefly the years 1900 to 1908 and in much greater detail the years 1909 to 1936. For this later period figures will be given showing the industrial origin of realized income and within each field the different types of income. Some of the more general results of this study are being prepared for early publication in the *Conference Board Bulletin*. Other special income studies are in preparation of which the most ambitious is an investigation of income by income size groups.

Following his study of the "Economic Development of Germany under National Socialism," Mr. Vaso Trivanovitch, Chief of the Board's Department of International Affairs, has spent several months abroad gathering material for a study of the economic position of Russia, and a similar study of the economic position of Italy.

The Board will publish shortly a review of national wealth estimates, assembling the available material and discussing how they are made and what significance is to be assigned to them.

The Department of Public Finance is making a study of the taxation of business and is collecting material for the Board's annual volume on the cost of government.

Research Projects at Dun & Bradstreet, Inc.

Business Trend Survey. An inquiry known as the "Business Trend Survey" replaces the Retail Survey which has been conducted for the past four years showing operating averages for somewhat more than 100 retail trade classifications. The Retail Survey will not be undertaken this year as the four-year study revealed little shift in the annual percentages, and these were commonly in the expected direction.

Business Trend Survey figures will first be published on a summary basis, but detailed regional and trade analyses will follow within a short period thereafter. The questionnaire, which has been sent to all of the 2,100,000 names in the Dun & Bradstreet Reference Book, asks for information in four specific categories covering the three-year period of 1935, 1936, and 1937. The first question deals with annual sales volume, the second with the vital subject of inventory, the third with receivables, and the fourth with expenditures for additions and improvements. Through the last item it is hoped to learn the attitude of business men toward permanent investment under present economic conditions. Results will cover manufacturing, wholesaling and service lines, as well as retailing.

Natural Business Year Study. A series of bulletins on seasonal fluctuations and suggested fiscal closing dates for various industries and trades is being compiled at the request of the Natural Business Year Council, an organization representing accountants, credit men, and credit agencies. The study has been undertaken in the belief that dissemination among business men of a wider knowledge of the seasonal patterns of production, sales, inventories, receivables, and liabilities will be helpful to management in various ways, in addition to its specific bearing on this problem. The position of Dun & Bradstreet, Inc. is solely that of impartial fact-finding agency. Promotion of the "Natural Business Year" as a concept remains a function of the Natural Business Year Council.

Arguments offered by proponents of a "Natural Business Year" include the following:

- a. That a business concern can most easily take inventory and audit books at a slack period when personnel is not rushed,
- b. That accountants would be able to do better work for their clients, possibly at less cost, if books were closed on dates other than the end of the calendar year,
- c. That banks, credit reporting agencies, and others concerned with granting credit can analyze the true health of a business concern more accurately and readily from a balance sheet taken when current items are not subject to rapid change.

Business Births and Deaths. For the past two years a study of the business changes in business ownership in the United States has been analyzed by a special staff of the Research and Statistical Division of Dun & Bradstreet, Inc. The Company's network of offices is continually making its contribution

to this study. At the time investigations are made, these offices make special records of all available changes, classifying them as to whether they are an individual ownership, partnership, or corporation and they are further segregated to show whether it is a new business or a succession including old ownership or a succession eliminating old ownership.

These changes are divided into five groups, manufacturers, wholesalers, retailers, construction and commercial service, and within these groups are classified similar to the major divisions used by the United States Census. This analysis was first released in the February, 1937, issue of *Dun's Review*, entitled "Business Births and Deaths." It reviewed the relative changes in enterprises by industrial divisions, also the percentage of new enterprises, and disappearances in each division for the first six months of 1936. A later record showed the type of changes occurring in each of the five major trade divisions for the similar period. This work is now nearing its completion for the year 1937, at which time a comparison will be made of business changes occurring during the past two years.

Objections come from the viewpoint of students of industry as a whole. Compilation of census and some other annual figures would become increasingly difficult because part of an industry would adopt the new fiscal year, and part would remain on a calendar year. This might be solved in some industries by united action—such as the simultaneous shift of most of the fertilizer industry to a new fiscal year under the sponsorship of the National Fertilizer Association.

Each bulletin in the series covers a single industry and comprises three sections:

- a. Discussion and graph of seasonal fluctuations from various published and unpublished sources.
- b. Summary of available information on fiscal closing dates used in the industry or recommended for it.
- c. Recommendation of a fiscal closing date, with reasons.

The preliminary draft of each bulletin is personally checked with executives in the industry by Dun & Bradstreet Reporters.

CHAPTER ACTIVITIES

The Albany Chapter

The Chapter held a dinner meeting on December 7, 1937, with F. J. Decker, President, presiding. Twelve members and guests were present.

There was a general discussion of the possibility of forming a permanent committee on state titles for statistical work, but no action was taken.

Professor E. R. Nelson of Russell Sage College discussed the special meeting of the American Statistical Association held in Denver in June, 1937, in connection with the summer meeting of the American Association for the Advancement of Science, with particular reference to the following papers: "Residence Allocation of Births and Deaths" by Halbert L. Dunn, M.D., Bureau of the Census; "Measuring Reemployment Possibilities of Workers on Relief" by F. L. Carmichael, Works Progress Administration; and "Relation Between High Profits and High Wages" by Carl Snyder, New York City.

Mr. R. F. Bucknam, Vice-President, presided at a meeting of the Chapter on January 25. Twenty-seven guests and members were present. The Chairman announced the appointment by the President of the Chapter of a committee interested in securing a classification and salary standardization rating for statisticians employed in New York City under Civil Service on a basis in line with that of other professional groups. The committee consists of Dr. Warren W. Coxe, Chairman, Dr. Roy L. Gillett, Dr. Benjamin Malzberg, Charles C. Dubuar, and Mildred M. Lauder. This action of the President was approved, and after further discussion it was voted to appoint a second committee to investigate the possibilities of more carefully defining the *professional* status of statisticians.

Dr. J. V. De Porte, Director of the Division of Vital Statistics, New York State Department of Health, gave a very interesting talk on "The American Race in the Making" based on a paper he delivered at the International Population Congress at Paris. Using the term "race" to represent the layman's concept of certain biological and cultural differences among the peoples of Europe, he pointed out that the pattern of an American race, as a distinct type, is still in the making. The synthesis of diverse racial components is directly influenced by the differential rates of marriage, fertility, and mortality. Dr. De Porte presented these differential rates for the population of New York State. A study of the main demographic indices of the population of Upstate New York indicates a progressive levelling of the racial differences in fertility and mortality. The marriages are still largely intra-racial, but the number of interracial marriages is growing, their prevalence being directly dependent upon social propinquity and similarity of economic and cultural interests.

The Boston Chapter

A meeting of the Boston Chapter of the Association was held in the Walker Memorial Room of Walker Hall at the Massachusetts Institute of Tech-

nology on November 23, 1937. After the dinner and a short business meeting, Mr. Edmund S. Cogswell, First Deputy Commissioner, Massachusetts Department of Banking and Insurance, and Mr. Charles S. Warren, Secretary, Massachusetts Automobile Rating and Accident Prevention Bureau, addressed the meeting on the subject of "Automobile Liability Insurance."

The papers dealt with the making of compulsory automobile insurance rates in Massachusetts from a statistical standpoint. The law, which was put in force beginning with January 1, 1927, provides that the Commissioner of Insurance shall fix the rate. To assist in this work an arrangement was made with the insurance companies whereby the Massachusetts Automobile Rating and Accident Prevention Bureau was created to collect the statistics. The Commissioner is furnished each year with a record of the accidents according to each city or town in which the car causing the accident is principally garaged.

In the fixing of the rates, the Commissioner thus finds himself between the companies on the one hand, who want to break even or make a profit, and politicians and the people on the other hand, who wish to keep the rates low. The law provides that public hearings must be held in the matter of rates, and they are subject to judicial review.

In recent years the rates have applied to around 550,000 passenger cars; premiums for insurance on passenger cars of 19.7 million dollars were paid in 1936, and claims amounted to 11.8 million dollars. Claims have averaged 9.3 per 100 cars and cost of claims about \$250.

The basis of the premium is the average loss cost per private passenger car. The tendency of this basic figure has been upward, the pure premium in 1927 amounting to \$19.57 and in 1933 to \$23.27. The highest figure was \$25.50 in 1934. Figures for 1935 and 1936 were lower; in 1936, because of a dropping of guest coverage, the loss cost fell to \$21.09. The latter figures are roughly comparable with those of 1932, although no accurate figure for the cost of guest coverage can be computed. This upward trend in loss costs has naturally led to some difficulty in adjusting rates as between the Commissioner and the insurance companies.

In addition to the rates, the Commissioner also determines the reserves to be set aside by the insurance companies, and differences of opinion have developed between the Commissioner and the companies on this point as well as on rates.

After the determination of the basic rate, there is an expense loading amounting to 35.5 per cent. This loading expense is divided as follows:

	Percentage
Home Office	7.5
Claim Expense	10.5
Inspection and Bureau	1.1
Taxes	2.4
Acquisition and Cost	12.0
Profit	2.0
	<hr/>
	35.5

Loss costs vary decidedly with the geographical unit, varying from \$43.85 in Chelsea to \$2.74 in Tolland; one town, Mt. Washington, went through a period of five years without an accident. Rates are adjusted on the basis of these variations in cost according to geographical districts. That rates should be varied according to geographical risks is coming to be regarded as the correct principle by the Commissioner and others acquainted with the insurance situation.

Mr. Warren called particular attention to the statistical methods followed in keeping the records. There are two punch cards, one for each policy and one for all claims filed. The number of cards passing through the hands of the Rating Bureau is presently expected to reach 2,000,000 per year. On the basis of the cards, 14 memoranda are prepared, summarizing the data.

One of the chief questions under continuous consideration by the Bureau relates to establishing the geographical boundaries of the districts upon which loss-cost rates are based. The question involved is: How small a geographical unit can be used and a satisfactory premium result? The different geographical units actually used are rated on the basis of actual experience, and a "credibility" percentage is worked out to indicate the accuracy of the figures for each particular district. Thus the credibility rating of Belmont is 90 per cent; the rate is based 90 per cent on Belmont experience and 10 per cent on "territorial" experience.

Discussion after the papers was chiefly upon the subject of reserves. The adequacy of reserves is admittedly a matter of judgment, and the final results of reserves set up in any given year are not available until after some such period of five years. The variations shown between actual claims paid and reserves previously set up against them have varied from a 2.7 per cent underestimate to a 1 per cent overestimate, according to Mr. Warren. These differences he did not believe to be important; that is, the estimates of necessary reserves have, on the whole, been very close to the costs subsequently paid out of such reserves.

The Tenth Annual Meeting of the Boston Chapter was held at the Boston City Club on Friday evening, January 21, 1938. There were 44 members and guests present. At the business session the following officers were elected to serve during the ensuing year:

President, (to be elected at the next meeting)

Vice-President, Theodore H. Brown, Harvard Graduate School of Business Administration

Secretary, Roswell F. Phelps, Massachusetts Department of Labor and Industries

Treasurer, E. L. Quirin, Babson's Statistical Organization

Counsellors: Charles A. Bliss, Harvard Graduate School of Business Administration

Howard C. Baldwin, Babson's Reports, Inc.

The general subject for discussion at this meeting was "Business Forecasts for 1938." The speakers were: Dr. Hermann F. Arendtz, Economist, United

Business Service, Boston, Nicholas E. Peterson, Industrial Statistician, First National Bank, Boston, and H. Clyde Baldwin, Economist, Babson's Reports, Inc., Wellesley Hills, Mass. The three speakers were closely in accord in their belief that there would be no marked recovery in business in general during the first half of 1938, but that during the second half of the year there would be definite improvement, conditioned, however, upon such action by Congress and the National Administration as would restore confidence and justify the making of commitments by business enterprises.

Dr. Arendtz stated "that the almost complete stoppage of new ordering in the late months of 1937 would lead to a using up of inventories that would make new ordering in an increasing number of lines necessary early in the new year. There is already evidence of this. Retail trade has held up remarkably well, and the offtake of merchandise stocks has been not far from that of a year ago. But unemployment has risen ominously, and public buying power is declining. Until it rises again, no substantial business advance can get under way. Prices must come down, and wages with them before that result can be obtained. . . . Much—very much—depends on the governmental attitude, and on this point I cannot feel much optimism. We ventured the forecast that a real improvement would begin by autumn. I must admit that an important ingredient in that forecast was the hope that the Administration would see the necessity of changing its attitude toward private enterprise, capital and business profits."

Mr. Peterson called attention to the fact that labor costs rose 20 per cent in the 12-month period ending June 1937, while production decreased, that the epidemic of sit-down strikes caused industry to refuse to make long-time commitments, to expand plants or to plan far ahead. He believed that the cost of living should be reduced because there had been a 25 per cent drop in pay rolls but only a five per cent decrease in the cost of living.

Mr. Baldwin expressed the opinion that the present recession is largely an inventory problem and that with a reduction in the supply of merchandise in hand there will be a resumption of production. He discussed the prices of various classes of stocks and named several classes which he believed would justify consideration for investment purposes later in the year.

The Chicago Chapter

"The Business and Financial Outlook" was the general subject of discussion at the first meeting of the Chicago Chapter on October 27th. The topic was particularly timely because of the rapid downward movement of the market at the time. Charles A. R. Wardwell, Associate Professor of Finance and Statistics at Northwestern University and member of the Research Department of Sheridan, Farwell, and Morrison (Investment Counsel), gave an analysis of business conditions and an evaluation of the seriousness of the recession. Based on the factors which had led him to anticipate the market decline and on current conditions, Professor Wardwell stated his belief that a further decline could be expected but that it would not reach the proportions of a major depression unless some new phases should develop.

He was of the opinion that the down-swing of the business cycle would be compensated to some extent by the fact that it coincided with an upward movement of the long-term cycle.

Robert P. Vanderpoel, Financial Editor of the *Chicago Evening American*, also expressed the opinion that the conditions did not appear similar to the 1929 depression and that a revival of business was not far distant. The meeting concluded with comments by Professor Theodore O. Yntema of the University of Chicago, Mr. Harland H. Allen of Harland H. Allen Associates, and Dr. John W. Boatwright of the Standard Oil Company. There were 112 present at the meeting.

The second meeting of the chapter was devoted to the subject of "Agricultural Control." Professor Asher Hobson, Chairman of the Department of Agricultural Economics of the University of Wisconsin, spoke of the economic aspects of agricultural control. Professor Hobson said that three considerations must be kept in mind. (1) that it is a long-time program; (2) that the welfare of the farmer does not necessarily coincide with the welfare of nations; and (3) that the interests of one group of farmers may be in direct conflict with the interests of other groups. In order to have effective control, a degree of isolation from world prices is necessary.

Professor Elmer J. Working, Associate Professor of Agricultural Economics of the University of Illinois, discussed some of the basic statistical research of the control program. He stated that parity prices and parity income constitute an attempt to measure economic balance but the fact that a high level of business activity is essential to a prosperous agriculture is often overlooked. The program concluded with discussions by Professor E. A. Duddy of the University of Chicago and Mr. Nat C. Murray of Clement, Curtis and Company.

"The Housing Program and Building Industry" was the topic of the third meeting on January 18th. Dr. Coleman Woodberry, Director of the National Association of Housing Officials, in his discussion of Public Aid and Enterprise in Housing, said that the Housing Program included both public assistance to builders and direct building. He discussed the various governmental agencies, their functions and accomplishments. He then raised the question as to whether private and public enterprise could be carried on successfully at the same time, stating that in his opinion they could supplement each other very advantageously.

Herbert U. Nelson, the second speaker, Executive Vice-President of the National Association of Real Estate Boards, agreed that the public agency has a definite function to perform in the housing field along with private enterprise. The question was how to work it out in the best way. The chief obstacles to private building are: (1) the uncertainty of business conditions resulting in a feeling of insecurity regarding the future; (2) high material costs; and (3) high labor costs. Concerning material costs. Mr. Nelson said the manufacturers were aware that the present distribution system was an expensive one and they were trying to find ways to make it more direct and less costly. The solutions suggested were the development of home building

companies set up with large capital, like automobile companies, so that they would have sufficient bargaining power to come to terms with both the suppliers of materials and of labor; and cooperative housing, or organization of the buyer. Mr. Nelson also gave information based on a survey just completed, of building conditions in a wide sample of urban areas. This survey indicated that the real estate market is in a healthy condition, with an undersupply of single family dwellings in 52 per cent of the communities and a prospective immediate shortage in 48 per cent more, an undersupply of apartments in 40 per cent, and capital actively seeking investment in the building field in 73 per cent of the areas reporting.

The Cincinnati Chapter

Three meetings have been held so far this winter. Dr. Paul Horst, Personnel Research Department, Procter and Gamble Company, addressed the first meeting, October 28, on the work of Professor J. B. Rhine, psychologist of Duke University, on clairvoyance. The second meeting, on November 18, was addressed by Dr. D. P. Smelser, manager of the Market Research Department of Procter and Gamble Company, on fundamental problems in Market research. Another department of the same company, the Industrial Relations Division, provided the third speaker of the season, Dr. Elmer B. Royer, who outlined a procedure for mass computation of correlation coefficients on Hollerith tabulating machines.

The Cleveland Chapter

The activities of the Chapter during the present season have been confined to meetings of the Business Statistical Section. On November 8, 1937, Mr. Vanden Bosch of the Cleveland Chamber of Commerce addressed the group on the significance of the Chamber's index of employment in 100 industrial concerns.

On December 13, Mr. Raymond T. Cragin of Cragin, Morris and Company, realtors, addressed the group concerning the future of the construction industry, particularly from the standpoint of residential building. Mr. Cragin stated that he did not think that the present level of building activity is discouraging since it compares favorably with pre-boom levels. He further stated that we cannot expect building to lead us out of a depression, since house building depends on accumulated savings and a feeling of economic security for the future. He further stated that at present the number of skilled building workers is not large enough to meet the labor requirements of a building boom.

Mr. Leigh S. Plummer, Manager of the Cleveland Bureau of the *Wall Street Journal*, gave a talk on January 18 in which he discussed inflation. He discussed the use of ratios derived from banking figures in determining strength of underlying factors affecting prices of bonds, equities, the interest rate on short term loans, and the general price level along the lines suggested in the book *Seven Kinds of Inflation* by Richard Dana Skinner.

The attendance at the four group meetings held so far this season has averaged 26 members and guests, a 15 per cent increase over the previous season.

The Connecticut Chapter

A joint meeting of the Connecticut Chapter and the Connecticut Control of the Controllers Institute of America was held on January 5. Mr. A. W. Zelomek, President and Economist of the International Statistical Bureau, Inc., and Economist of Fairchild Publications, New York City, spoke on "The Causes of the Current Decline and the Prospects for 1938." A period of discussion followed Mr. Zelomek's address.

The New York District Chapter

"The Outlook for Industry" was the topic of a meeting of the New York District Chapter on December 1, 1937. Professor Wesley C. Mitchell presided. Mr. John McInerney of Wood, Low and Company presented "The Outlook for the Railroads." The prospects for "Foreign Securities" were discussed by Albert Kimber of White, Weld and Company. Thomas S. Holden, Vice-President in charge of Statistics and Research of the F. W. Dodge Corporation, spoke on "The Outlook for Building." A very lively general discussion followed.

The Pittsburgh Chapter

A dinner meeting of the Pittsburgh Chapter was held on November 19, 1937, in conjunction with the Pittsburgh Economic Club and the Pittsburgh Personnel Association. A symposium was conducted on "What New Inventions Will Do With Us and For Us." The symposium was led by Dr. William F. Ogburn, with Dr. Robert E. Doherty, President of Carnegie Institute of Technology, presiding. The discussion, which was opened by Mr. Howard N. Eavenson, was participated in by a large number of those attending. Approximately 120 members of the three organizations attended the meeting.

A luncheon meeting of the Chapter was held on January 27. Thirty-eight members were present and participated in the discussion on "Measurements of Unemployment in Allegheny County." Dr. B. J. Hovde, Director of the Department of Public Welfare of the City of Pittsburgh, opened the discussion on the possibility of a continuous local census of the unemployed. He expressed the need for such a count and the possible utilization of existing indexes of employment and records kept by the relief agencies and the employment offices. Dr. Hovde discussed the value of the census to business organizations and to the City government. Dr. J. P. Watson of the Bureau of Business Research, University of Pittsburgh, gave a brief description of the index of employment as prepared by the Bureau of Business Research, and emphasized the limitations of this index in estimating the volume of unemployment. The final speaker, Mr. John D. Beatty, Secretary of the Pittsburgh Personnel Association, discussed the local situation with regard

to unemployment of white collar and technical workers. Mr. Beatty emphasized the need for technical education and urged the encouragement of greater use of the facilities now in existence in the community. He pointed out the scarcity of skilled craftsmen in certain types of work which have developed during the depression as, for example, the use of glass bricks in construction.

The San Francisco Chapter

The Chapter held its annual meeting on November 4, with President M. K. Bennett presiding. The following officers were elected for the ensuing fiscal year: President, Dr. Murray R. Benedict, Giannini Foundation, University of California; Vice-President, Mr. Douglas R. Fuller, North American Investment Corporation; and Secretary-Treasurer, Mr. Wm. A. Sturm, Research Department, California State Chamber of Commerce. Dr. Benedict appointed the following as members of the Executive Committee: Dr. M. K. Bennett, Food Research Institute, Stanford University, and Mr. N. M. Sherman, Division of Analysis and Research, Federal Reserve Bank of San Francisco. The Secretary-Treasurer reported that the membership of the Chapter on October 1, 1937, was 111. The Chapter held 6 meetings during the fiscal year and the average attendance was 35. There was a balance of \$179.54 in the treasury at the end of the year.

Dr. Edward K. Strong, Jr., Professor of Psychology, Stanford University, spoke on "Statistical Procedure in Scoring the Vocational Interest Test." The following is a summary of the address.

The Vocational Interest Test is a blank listing 420 items selected to help determine occupational adaptability in terms of personal interests. The person who is tested checks each item in terms of three possible responses, "Like," "Dislike," and "Indifferent." The items selected are those for which different occupational groups tend to present different responses. The pattern of interests characteristic of successful members of an occupational group is revealed by this test and it is not likely that a person will be happy or successful in an occupation in which the pattern of interests is quite unlike his own pattern.

The Washington Statistical Society

A meeting of the Chapter was held on November 23, 1937, to discuss the "National Unemployment Census." The speakers were Dr. Stuart A. Rice, Chairman of the Central Statistical Board, and Dr. Calvert L. Dedrick, Technical Adviser to the Administrator of the National Unemployment Census.

NEW MEMBERS

- Allen, Margaret F., Statistical Technician, School of Public Health, Harvard University, 55 Shattuck Street, Boston, Massachusetts
- Alsberg, Dr. Carl L., Director of the Giannini Foundation, University of California, Berkeley, California
- Anton, Leonard R., Technical Analyst, Social Security Board, 1712 G Street N.W., Washington, D. C.
- Backman, Dr. Jules, In Charge of Financial Research, Dorau and Madden, Two Rector Street, New York City
- Ballinger, Willis J., Economic Adviser to the Federal Trade Commission, Washington, D. C.
- Banachowski, Chester, Statistician, Division of Standards and Research, U. S. Employment Service, Department of Labor, 401-22 Light Street, Baltimore, Maryland
- Barry, David C, Vice-President, Lincoln Alliance Bank and Trust Company, 183 East Main Street, Rochester, New York
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- Berlet, George N., Jr., Statistician, Green, Ellis and Anderson, 100 Broadway, New York City
- Bonnett, Dr. Clarence E., Professor of Economics, Tulane University, New Orleans, Louisiana
- Brown, James T., Manager of Statistical Department, Shields and Company, 44 Wall Street, New York City
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- Campbell, F. N., Senior Economic Analyst, Division of Research and Statistics, Treasury Department, Washington, D. C.
- Catlin, Malcolm B, Assistant Director, Division of Research, Statistics and Records, Works Progress Administration, Washington, D. C.
- Caulfield, William, Assistant to the Statistician, Hamilton Watch Company, Lancaster, Pennsylvania
- Craig, Professor Allen T., Associate Professor of Mathematics, The University of Iowa, Iowa City, Iowa
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- Di Salvatore, Philip, Research Assistant, Princeton University, Princeton, New Jersey
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- Elting, John P., Research Physicist, Kendall Mills, Paw Creek, North Carolina
- Ely, J. Edward, Associate Economist, U. S. Railroad Retirement Board, Washington, D. C.

- Farley, Jarvis, Assistant Treasurer, Massachusetts Indemnity Insurance Company, 632 Beacon Street, Boston, Massachusetts
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- Helm, Dr. Florence, Senior Research Assistant, Division of Research and Statistics, Federal Deposit Insurance Corporation, Washington, D. C.
- Hill, Betty M., Statistician and Research Consultant, Illinois Emergency Relief Commission, Merchandise Mart, Chicago, Illinois
- Hill, Professor Pope R., Assistant Professor of Mathematics, University of Georgia, Athens, Georgia
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- School of Commerce, New York University, Washington Square, New York City
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- Nichols, Russell, Economic Analyst, Division of Research, Treasury Department, Washington, D. C.
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- Ramsey, Fredlyn, Associate Specialist in School Finance, Advisory Committee on Education, 7124 North Interior Building, Washington, D. C.
- Reece, Dr. B. Carroll, Member of Congress, House of Representatives, Washington, D. C.

- Reed, Dr. Vergil D., Assistant Director, Bureau of the Census, Washington, D. C.
- Roberts, Dr. E. D. G., Chief, Land Policy Section, Land Utilization Division, Department of Agriculture, Masonic Building, Amarillo, Texas
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- Young, Mrs. Agnes Brooks, 3280 Chadbourne Road, Cleveland, Ohio

REVIEWS

Government Statistics, A Report of the Committee on Government Statistics and Information Services. New York: Social Science Research Council. Bulletin 26. 1937. xiv, 174 pp. \$1.00.

The widely heralded "brain trust" group was a tiny fraction of the academic procession to Washington in 1933. This document tells the story of the statistical division of the migration.

There were at least two good reasons why the Spring and Summer of 1933 were critical for Government statistics. The state of the budget had already made serious inroads into statisticians and current statistical activities, and the inevitable revolution in personnel threatened the survivors. At the same time, however, there were members of the new Cabinet who saw the situation not as a threat but as an opportunity to review and revise the statistical work of the Government.

In June, 1933, on the basis of an understanding with the secretaries of the Federal departments concerned, the American Statistical Association and the Social Science Research Council jointly organized a Committee on Government Statistics and Information Services. That those concerned with Government statistics should act cooperatively was not a new idea. Government statisticians had a common organization in the Federal Statistics Board, although it never was very effective, since it lacked authority, staff, and funds. Occasionally outsiders were brought in for consultation through such agencies as the Census Advisory Committee. What was new was the establishment in Washington of a paid staff giving full time, not in the Government but with a quasi-official status, directing itself primarily to an objective examination of statistical policies and practices. Nor was this merely a matter of coaching from the bench. Time and time again, the representatives of COGSIS actually took the ball and, although they were sometimes thrown hard for a loss, occasionally made spectacular gains.

There are certain problems which any program for Government statistics must face. These are not only matters of technical standards but of operating relationships. The Government must consider its relation to private enterprises, which are frequently both suppliers of raw material and users of finished reports. Within the Government there are dangers of competition for personnel and funds for other projects, jurisdictional disputes and jealousies, nonsympathetic supervision, ill-considered statistical planning, if any, and the like. One of the earliest recommendations of non-official COGSIS was the establishment of an official Central Statistical Board. The CSB was created by Executive Order on July 27, 1933, and given a five-year life by Congress two years later.

The Report gives the mature judgment of those who were active in the picture as to the broad pattern of policy which should be followed in developing an integrated statistical program. It is based upon the proposition that

statistical work should not be undertaken in a vacuum, by telescope, or by remote control. Except for routine tabulation and the like, which may be centralized, responsibility should be located at the functional point, which also should be the point of greatest interest. In many cases this might lead to work by private or State agencies, rather than the Federal Government. Such a decentralization, however, makes necessary procedures assuring coordination. It is proposed that this be attained by means of interdepartmental committees and the operations of the CSB. Furthermore, over the entire field, the CSB should have direct responsibility for the utility, practice, and personnel of statistical projects. The discussion is exceedingly pertinent, since much of the program is already in operation. The Report is in part a justification and in part a declaration of principles for the CSB.

This general summary gives an erroneous impression of the Report, inasmuch as it is packed with the discussion of specific problems and detailed recommendations for improvements in existing statistical work. It urges a modification of established secrecy rules. It emphasizes the waste involved in the failure of printing budgets to permit publication of completed studies. It advocates the centralization of existing consumer services. It even suggests more extensive use of the sampling technique by the Bureau of Fisheries, interestingly enough, a technique used by the constituents of that Bureau almost entirely.

The essential significance of this Report is not in its detailed recommendations but in the character of the project itself. It pictures statisticians taking no mere passive role, analyzing whatever data are available and cursing in isolation over the inadequacies of their raw material. Here is a vigorous effort to do something about it. A small group was involved in the venture—but its ultimate accomplishment depends upon a continuing concern on the part of statisticians generally.

The usual test of a business enterprise is market absorption of its product. The number of satisfied customers is indicated by its sales volume. Statistical work by Government agencies is in part for purposes of determining Government policy, but much of it must be justified chiefly on the basis of its usefulness to outsiders. These consumers do not record themselves as they would by purchasing commodities. If we desire an improved and increased Government statistical program, we must find ways to express our interest and concern. We use census data but never report their value to the Census Bureau for its support in the annual budget battle. We delight in improvements in the wholesale price indexes but fail to express our appreciation to the Bureau of Labor Statistics. We wish speedier tabulation of income tax records but never supply ammunition to the Treasury Department officials who might be sympathetic with the request. Such demonstrations by the consumers of statistics are of tremendous importance to those responsible for planning the program and the expenditures of Government agencies. That support is essential is already indicated by the misfortune of the CSB in the sharp curtailment of its budget by Congress. The valiant efforts here reported to

advance Government statistics will be successful only if statisticians themselves continue to press for improvement.

The Report is distressingly lacking at one point—it fails to give adequate recognition to the two individuals who gave leadership to COGSIS, Stuart Rice and Meredith Givens. Many others, of course, contributed in one way or another, but to these two belong the greatest part of the credit. The American Statistical Association may properly be proud of having joined with the Social Science Research Council in sponsoring this project.

WILLARD L. THORP

Dun & Bradstreet, Inc.
New York City

Statistical Methods Applied to Experiments in Agriculture and Biology, by George W. Snedecor. Ames, Iowa: Collegiate Press, Inc., of Iowa State College. 1937. xii, 341 pp. \$3.75.

The author sets as his objective in this book the gearing together of experimental data and statistical method for the beginner. "It is the novice to whose needs this book is directed. . . . The only mathematics used . . . is arithmetic, supplemented by enough symbolism to make the exposition intelligible. . . . The easiest ideas are put first, and only one new concept is presented at a time." With simplicity of verbal exposition as a keynote, the readers are addressed directly in the informal conversational style of a laboratory discussion between an understanding teacher and his responsive student. The use of this form by Snedecor will probably impart a sense of ease and confidence to the beginner.

The instruction commences with a discussion of the sex ratio among guinea pig progeny, using the observed numbers in 12 litters yielding 18 male and 12 female descendants as basic data. Falling back on wider experience for a more dependable basis of hypothesis concerning the true sex ratio—"It is known, of course, that there are almost equal chances for any cavy to be male or female"—the notion of parameters and sampling statistics is briefly developed. The reader is then introduced on the fourth page to the measurement of discordance between observed and theoretical frequency by the χ^2 formula. A set of problems providing exercise in this computation follows immediately. The chapter then proceeds with a discussion of the sampling distribution of χ^2 , briefly mentioning the histogram and frequency curve in passing to establishment of the 5 per cent point as a basis of tests of significance. Introducing percentages and the fourfold table, more drill in χ^2 follows. Five sets of problems embracing 27 exercises in all are interpolated in the text of this chapter and also some half dozen modifications of the basic formula adapted to particular situations. There is no mention of degrees of freedom so far; technical correctness of statement is sacrificed occasionally, presumably to attain brevity of consideration. Reference to the binomial theorem is preserved for the closing pages of the book.

The principle of instruction is apparently not to disturb the reader by mathematical generalization but to extend him through the analysis of selected numerical examples closely following the given types. The aim is to demonstrate a formula achieving results, thus fostering enthusiasm for it as a tool. Perhaps it is in order to restrain that enthusiasm from too ardent expansion in the reporting of research that the chapter concludes with an admonition given repeatedly in the book in diverse forms: "Don't publish computational details or discussions of statistical methods." One wonders if it is not this detailed teaching in terms of computational procedure related to specific examples, at the expense of full consideration of the principles of reasoning on which statistical tests rest, which stimulates the all too common effusion of the tyro.

This review of the first chapter must serve to indicate the general instructional procedure of the whole volume. Consideration of measured variables in sets of small frequency follows, with development of the variance formula and the t test of significance. An analysis of rectilinear regression, still with very few observations in each experiment, introduces a following chapter on the correlation coefficient. An attempted rationalization of the correlation coefficient in terms of the special case of "common elements," rather than with regard to the normal bivariate frequency distribution which alone it describes without restriction, seems to the reviewer to be misleading.

Designated as "Large Sample Theory," the eighth chapter considers for the first time computational procedure in samples large enough to warrant a frequency table. The author calls for "at least 20 classes for precise work, preferably more"(!) The chapter includes tests of normality involving Fisher's k statistics to the fourth order, and the normal curve is tabled. Considerations of theory are certainly not any more manifest in this chapter than elsewhere.

The second half of the volume is concerned chiefly with the computational procedures involved in simple analyses of variance and covariance, with a chapter devoted to multiple regression and covariance. There is a chapter on curvilinear regression that provides an exposition of procedure for fitting the polynomial up to high orders by successive stages, using Fisher's scheme of calculations—an exposition which some computers beyond the novice stage may appreciate. The closing comments of this chapter counsel against contributing to the "stupendous amount of time [which] has been wasted on ill-advised curve fitting. Only when the end in view is clear should the task be undertaken." The rather perfunctory chapter on "Binomial and Poisson Distributions" which closes the instruction might well have been omitted. Distribution problems in general are inadequately handled. The student is not encouraged to focus attention on extensive enough series for such studies.

The arrangement of the material has several distinctive features. Sections which "may be safely omitted by the beginner" or those "attempting to get only an outline of statistical methodology" are indicated in the text. These

sections embrace 72 per cent of the total pages of the book, leaving a very brief outline for the digest minded reader. For the exercise of the others, the book excels in presenting nearly 400 problems in sets at appropriate places for solution.

All subject matter sections (of which there are 6 to 17 per chapter), tables, figures, and examples are designated by chapter as well as serial number for location in cross reference. It is unfortunate that the author did not adjust these key-numbers in final proof to embrace page number and so facilitate greatly the location of needed material.

A more extensive table of 5 per cent and 1 per cent points for F is included in the text. The 528 pairings of n_1 and n_2 so provided will be appreciated by all who find the interpolation in more skeletal tables vexing. One regrets that the tables of χ^2 , t , and F , to which reference is called for so freely, are not collected at a single region of ready access.

Such skepticism concerning certain values of this book as is manifest in the foregoing remarks emanates from a conviction of the reviewer that there is great danger in teaching statistical methods without building at the same time a clear understanding of the reasons validating each procedure. By all odds the most difficult field of statistical analysis, that of drawing sound conclusions from very limited information, is made to appear simple and without trace of hazard. Confidence gained through learning how to apply a formula does not convert a computer into a wise interpreter. If this missing information be supplied by a competent instructor, as surely it is in Snedecor's own classes, then the value of the book will rise to a high level. Students of agrobiolgy will appreciate learning statistical procedure from a painstaking and indulgent teacher, but they will not really know what they are up to until they can clearly state the reason why for each step in their own words.

A. E. TRELOAR

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Linear Regression Analysis of Economic Time Series, by T. Koopmans. Haarlem: De Erven F. Bohn N. V. Monograph Number 20 of the Netherlands Economic Institute. 1937. xi, 150 pp. f. 2.

Dr. Koopmans' monograph is primarily a theoretical treatise on the possibility of using the method of linear regression, together with an appropriate probability theory for making significance tests in the analysis of economic time series. The author devotes the first half of the book to a statement of the problem, a discussion of mathematical tools to be used, and a detailed review of three existing regression methods, namely:

- (1) R. A. Fisher's method of elementary regression, in which the main assumptions are that (i) the independent variables are regarded as fixed, that is, without error, (ii) the residual differences between the

dependent variable and a linear (regression) function of the independent variables are normally distributed. The method of estimation of parameters and sampling theory of the estimates for Fisher's system are systematically developed and discussed.

- (2) R. Frisch's method of diagonal regression in which all variables are regarded as being subject to error. This method is used by Frisch in his *confluence analysis* and his main contention is that an analysis (search for linear or "nearly" linear relationships) should be made in which all variables enter into the analysis symmetrically. This method is seriously handicapped by the fact that there is not yet available an appropriate probability theory for reckoning significance of values of calculated regression coefficients and other statistical quantities. Dr. Koopmans does not attempt to supply such a probability theory.
- (3) M. J. van Uven's method of weighted regression in which all variables are assumed to be normally distributed about respective means with a given matrix $\|\sigma^2\epsilon_{i,j}\|$ of variances and covariances, the means being the same for the various values of t (time) and satisfying a linear regression equation. Van Uven's procedure for determining the regression coefficients essentially consists of maximizing the probability of the observations for each value of t with respect to the means, then maximizing, with respect to the regression coefficients, the product of these maxima for the several values of t . The maximizing values of the regression coefficients are called the weighted regression coefficients. These weighted regression coefficients will involve the variances and covariances of the deviations of the variables from their means. Unless these variances and covariances are known *a priori*, the method will clearly be valueless from a practical point of view.

It is perhaps worth noting that van Uven has obtained expressions for the variances of these regression coefficients, but he is guilty of neglecting to distinguish carefully between parameters and calculable estimates of these parameters.

Van Uven's method of weighted regression furnishes the point of departure for Dr. Koopmans' own work on the linear regression problem. Koopmans assumes that corresponding to the value of each variable for each value of t there is a "true" value, so that for each value of t the true values obey the same linear regression equation. The difference between each observed value and the corresponding "true" value is assumed to be distributed in a normal multivariate distribution which is the same for all values of t , the matrix of variances and covariances being $\|\sigma^2\epsilon_{i,j}\|$. The total number of parameters introduced to characterize the hypothetical distribution of the observations is greater than the number of observations, thus creating a statistically hopeless situation. The author extricates himself, however, by assuming the $\epsilon_{i,j}$ known *a priori*—thus reducing the number of unknown parameters. Under the assumption of known ϵ 's the author proceeds to

estimate σ^2 and the regression coefficients and to develop an approximate method of testing the significance of values of estimated regression coefficients. When $\epsilon_{i,j} = 0$ for i not equal to j , the results simplify considerably.

To illustrate his method numerically, the author applies it to the world ship freight market for the period 1880-1911, in which four variables are involved, namely, freight index, transport in ton-miles, tonnage, and coal price.

Although Dr. Koopmans' method is rather general, it takes no account of linear regression relationships of "true" values of variables for different values of time; that is, no consideration is given to the important case of time-lags. Other unsolved aspects of the problem are pointed out in the author's conclusions.

The book is mathematically rather elegant and is written in excellent English. It is concisely summarized at the end in English, Dutch, French, and German. The monograph should be of interest to mathematical economists, particularly those interested in time series.

S. S. WILKS

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Cost of Living in the United States, 1914-1936, by M. Ada Beney. New York: National Industrial Conference Board, Inc. 1936. N.I.C.B. Studies Number 228. ix, 99 pp. \$2.50.

The Conference Board's latest volume on the cost of living in the United States presents the most complete statement which has yet appeared of the Board's methods, both past and present, in securing and averaging retail prices and in computing its cost of living index. The report has four sections, a general chapter on the problems involved in measuring changes in living costs, a detailed description of the development of the techniques used in computing the group indexes which go to make up its general index of changes in living costs, a discussion of changes in such costs since 1914, and a statistical appendix.

The first section makes a useful distinction between studies of actual family expenditures and the cost of a definite standard of living and between indexes measuring changes in living costs in given places from time to time and those measuring differences at a given time from place to place. The discussion of the use of different weighting systems is less fortunate. It is stated that the "aggregate-expenditure method" should be used with commodities for which the demand is inelastic, and the "weighted-price-relative method" with those for which the demand is elastic without making clear that the two methods are intrinsically the same except when substitutions are to be made.¹ Neither in the general discussion nor in the detailed description which

¹ F. M. Williams, M. H. Hogg, and E. Clague, "Revision of Index of Cost of Goods Purchased by Wage Earners and Lower-Salaried Workers," *Monthly Labor Review*, Vol. 41, No. 3 (Sept., 1935), pp. 826-27.

H. B. Arthur, "Weighted Aggregates and Index Numbers," this JOURNAL Vol. 32, No. 198 (June 1937), pp. 363-64.

follows is there a statement as to the specific adjustments that are made by the Board in its weights for commodities for which there is an elastic demand. So far as it is possible to judge from the data presented in Chapter II, both systems of weighting are used with commodities for which the demand is inelastic and with those for which the demand is elastic. Both the quantity and expenditure weights have undergone a certain amount of revision in the 18 years during which the index has been computed. Clothing prices are multiplied by quantity weights (the aggregate-expenditure method) according to the formula:

$$\frac{\sum P_1 Q_A}{\sum P_0 Q_A} \times 100.$$

The quantity weights for this index were revised in 1929, because "some of the articles formerly priced had become obsolete with changes in style, and, on the other hand, certain articles, for example, silk hosiery, had come to be generally used by families of factory wage earners—" (p.24). The sundries index, late in 1936 when this volume went to press, was computed by the weighted price-ratio method, with weights representing "the estimated expenditure for the various sundry items in 1914."

The chapter on methodology which supplies more than one quarter of the book illustrates the difficulties in the way of calculating an accurate measure of changes from time to time in the cost of a given level of living in the United States. The efforts of the Conference Board in this field must be taken as a serious attempt to follow the general movement from month to month. It is evident, however, that the Board's staff has been and is handicapped by the fact that a systematic nationwide study of the family expenditures of wage earners and clerical workers was not made between 1919 and 1934. Important changes in consumption patterns occurred in the interval, and there was great need for revision of the weights of cost of living indexes. Such revision was, however, extremely difficult because of the absence of a comprehensive survey of current purchasing habits. The revised weights for the clothing index may serve as an example. "The weights used in the present clothing budget are no longer based on expenditures for such articles in 1914, but on the quantity estimated to be purchased in one year" (p.25). No children's clothing is priced because experiments conducted in 1918 convinced the Board that the ratio of change in the prices of children's clothing followed very closely the change in prices of adults' clothing. To select quantity weights for a limited number of articles of clothing in such a way as to give representation to garments of different fabric and construction proportional to their importance in all the clothing purchased for the family is extremely difficult. When up-to-date figures on family expenditures for clothing by the group for which the index is computed become available from the new studies of the Bureau of Labor Statistics, it will be possible to calculate imputed weights representing total expenditures for groups of items which move similarly in price and thus cover the whole range of family expenditures for clothing.

The Board's staff is also handicapped by the fact that funds have not been made available for field investigators who can check and supplement the data secured by mail. The differences in the number of cities covered for the various commodity groups are probably due to the lack of such a staff. The index of food costs is taken over from the Bureau of Labor Statistics and covers 51 large cities. Rents are obtained by the Board from 173 cities. Retail prices of clothing are obtained from 93, coal prices from 95, rates for gas and electricity from 174, data on carfare costs from 289; prices on drugs, toilet articles, and candy from a chain operating in 14 cities. Admission charges to movie theaters from 83 cities are obtained in October of each year. Newspaper prices are obtained in January and June in 94 cities, and the last survey of physicians' fees was made in November, 1925.

The differences between the indexes of rental costs computed by the Conference Board and by the Bureau of Labor Statistics, which have occasioned a great deal of comment, seem to be the result in large part of differences in the method of rent collection used by the two agencies.

"Rent questionnaires are sent each month by the Conference Board to real-estate boards, chambers of commerce, real-estate agents, social agencies, and individuals who are in close touch with the rental situation of their locality. Each cooperator is requested to state as of the fifteenth of the month the approximate average monthly rent for the accommodations specified on the form. In order to assure comparability of quotations from month to month, the quotations given by each cooperator for the previous month are entered on the questionnaire before it is sent to the cooperator."

The number of reports from the different cities varies. The rent index in a given month for a given city is calculated by securing the arithmetic mean of the percentage changes from the previous month reported by each cooperator and applying this average percentage change to the index of the previous month. The index for the United States is computed by weighting the arithmetic mean of the indexes of cities within certain population groups by population weights.

The representatives of the Bureau of Labor Statistics visit real estate agencies in 32 cities quarterly and secure rents on identical dwellings for the month of the visit and for the third preceding month. No quotations are used in the comparison for vacant dwellings, for dwellings where repairs have not been kept up to date, or where remodeling has occurred within the quarterly period. When a dwelling begins to decay or changes hands in such a way that the Bureau can no longer price it, another dwelling is substituted of similar type with similar facilities. Such a system presupposes a periodic revision of the sample of dwellings priced in order to keep the sample in line with current housing conditions. Such a revision is now in progress at the Bureau of Labor Statistics. The Conference Board Index has consistently moved ahead of the Bureau of Labor Statistics' index, except for a short period in 1922-23 when the Board's index shows a decline and then a sharp rise whereas the Bureau's index shows a more regular and gradual rise.

The reporters to the Conference Board on rent are immediately in touch with rent changes; they know the prevailing price at which certain types of dwellings can be leased. There is, however, no evidence that they have any mechanism by which they may calculate the proportion of new contracts in the total rental contracts among wage earners which have been revised within the month, and the consequent influence of newly established rental rates upon average rents. The fact that the movement of the Conference Board index persistently precedes that of the Bureau of Labor Statistics leads one to question whether the Conference Board's figures may not be overinfluenced by new contracts.

Without commenting on the methods used in combining prices and subindexes from cities, it seems worth while to question the validity of using unweighted combinations of data from cities of given size in different parts of the country, the resulting combinations being further combined with weights representing the relative importance of cities of that size. In the matter of rates for gas and electricity for example, variations may be correlated more closely with region than with size of city. A new power development does not influence cities under 500,000 throughout the country, though it may profoundly affect trends in its own area. The only work which has yet been done on the problem of the relation between the general movement of prices in small cities and nearby larger ones of which I know showed a very close correlation, but the number of cities covered was small and the time span too short to make the results of the experiment conclusive. Plotting trends in the movement of the indexes computed for 32 cities by the Bureau of Labor Statistics shows a closer relationship between the indexes for a given region than between indexes for cities of given size.

It is evident that there is a good deal of work remaining to be done before measuring changes in the cost of living can be regarded as an exact science.

In view of the baffling problems connected with cost of living indexes and the very considerable practical importance of alternative methods, it is clear that every serious study should be accompanied by a full statement of the procedure actually used and of the effect on the index number. The present volume makes a valuable contribution to the understanding of the index series it describes.

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An Index to Business Indices, by Donald H. Davenport and Frances V. Scott. Chicago: Business Publications, Inc. 1937. viii, 187 pp. \$3.00.

Users of business indices owe the authors a vote of thanks for providing a book which supplies in small compass a guide to more than 200 series. This

is not a book for the man who uses a few indices and knows each one of those intimately but rather a compilation useful primarily to those who make occasional use of business indices or those who use now one index and then another, as the needs of the moment may demand. The volume was prepared in order to enable business men and students of business and economics to ascertain quickly the nature and source of the more important business indexes which are published regularly.

The content of the book falls unto two parts, a finding index and a descriptive section. The finding index not only indicates the page upon which a given series is discussed but also states the frequency of publication. In addition the index shows, for a price series, whether prices are retail or wholesale; for a labor series, whether the data refer to employment, hours of labor, payrolls, or wages; and for a production or distribution series, whether the data refer to consumption, marketing, production, or refining. The descriptive section gives for each index the title, the compiler, the frequency of publication and period covered, the publication or publications listing current data, and a brief description of the series. Under the fourth of these headings the primary sources for current data are given first, following which a number of secondary sources may also be shown. Following the list of publications showing current data there is occasionally shown a source for back data, though certain obvious sources for back data (*Survey of Current Business*, *Statistical Abstract*, etc.) are not ordinarily mentioned. The descriptions are exceptionally complete, particularly in view of the space limitations. The components of the indexes are indicated. If indexes of subgroups are available the groups are listed. For many indexes the weights given to the various component series are listed. References are occasionally given to more complete descriptions.

The reviewer is in no wise disposed to be critical of such a workmanlike job as this. Since the volume is intended primarily for business men and students of business and economics, two suggestions are, perhaps, in order. First, it would add to the usefulness of the book if not only the name, but also the location, of the compiler of each index were shown. With but limited library facilities available, users might wish to secure publications from such compilers as Electrical World, National Fertilizer Association, Aberthaw Construction Company, Edison Electric Institute, and others. Second, it is suggested that whenever a detailed description of an index is available in printed form, mention be made of the publication in which the description appears and that it made clear in the "key" or introduction that when no such reference is given there is no adequate detailed explanation available.

One feature of the book is the inclusion of some 18 pages on which the user may enter pertinent information concerning other indices. It is to be hoped that the authors will issue revisions from time to time, keeping the information in this volume up to date.

FREDERICK E. CROXTON

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Statistics in Education and Psychology, by Elmer R. Enlow. New York: Prentice-Hall, Inc. 1937. ix, 180 pp. \$2.75.

The author has arranged clearly and simply in one volume "the fundamental principles of statistical interpretation, patterns and the logic of mathematical computation, and all the tables ordinarily needed in statistical research." Each statistical measure has been covered with conciseness and under the following subheads: Definition, Interpretation and Use, Formulas, Sampling Error (Reliability), Derivation of Formulas, Mathematical Properties, and Methods of Calculation.

The book contains chapters on frequency distributions, measures of central tendency and dispersion, probability and the normal curve, partial and multiple correlation, and errors in statistical work. In the appendices are given a bibliography, a glossary of symbols, and seven tables including alienation coefficients, Spearman R converted into Pearson r , and for the unit normal curve—abscissas and other values corresponding to assigned values of p and q , and areas and ordinates corresponding to given abscissas.

Although the book is designed for class room use, we believe because of its logical concise presentation that it would serve as an excellent handbook to the occasional worker in statistics. The words "in Education and Psychology" could be omitted, as statistics is treated quite generally. The publishers have presented the text in a very attractive form. The reviewer is impressed favorably.

HENRY A. ROBINSON

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Recurring Cycles of Fashions, 1760-1937, by Agnes Brooks Young. New York and London: Harper & Brothers Publishers. 1937. xiv, 216 pp. \$3.00.

In this report of a statistical study of the nature of change in apparel fashions, the author has, through applying scientific methods of analysis, measurement, and recording, reached conclusions which challenge most of the accepted theories of fashion change. Her conclusions are based on a wealth of factual data which leave no doubt as to the validity of her general conclusions. Further, Mrs. Young has developed a basic statistical method for measuring and recording fashion facts that should bring the light of reason to bear on the business of forecasting fashion. Further development of the method Mrs. Young used may bring results very different from those she now envisions, but the book will remain a major contribution to fashion merchandising.

Instead of tables of figures, the tools of this study are fashion illustrations taken from materials in the libraries of this country, of Paris, and of London, together with a few simple diagrams to show the method used in recording fashion trends. The author's original purpose was to study the relationship between fashion changes and the economic factors of depression and

prosperity. She soon became convinced from the material she examined that there was no such relation evident, but her painstaking research led her to a conclusion that is likely to have a much more vital bearing on the study of fashion, namely, that fashion changes in the 178 years included in her study have moved in a series of well-defined cycles, each of which lasted approximately thirty years. These cycles are characterized by the shape of the skirt, of which there appear to be three general types when the contour of the skirt is related to the figure underneath. The three skirt types, each of which recurs in the same order once each century and remains dominant for the cycle of thirty years, are the bell-shaped skirt, of which the hoop skirt was typical, the back fullness or "bustle" skirt, and the tubular skirt. Within the cycle of each skirt type there is opportunity for endless variety from year to year, changes in length and width of the skirt, as well as changes in sleeves, necklines, and belts. The author concludes that the changes that have taken place in fashion have been "continuous, constant, and moderate—never extreme or abrupt," and always variants from the dominant cycle.

The illustrations from which the author draws her conclusions are themselves the result of years of research to find a typical dress for each of the 178 years she studied. The statistical method she developed has great significance for fashion designers and retailers of fashion merchandise. Mrs. Young has indicated the direction in which her findings may be used to study trends and forecast fashion acceptance, and it seems likely that students will elaborate on her method and apply it to the wealth of fashion material available. Further study of her conclusions may indicate that, within the broad sweep of the cycles she defines, other factors such as economic changes and cultural developments have had an important influence without in any sense changing the concept of major cycles.

A much more detailed study of the significance and co-ordination of "trend lines" within the major cycles will be necessary before the method indicated will take the guesswork out of fashion merchandising. The statistical method and the type of material used in her studies are simple enough to encourage their widespread use by students interested in fashion research and analysis. Such research may yet reduce the vagaries of fashion to something approaching exactness.

The present cycle of the tubular skirt has already, according to Mrs. Young's figures, run its allotted course. It may well be, as the author indicates, that the pattern she has charted will be broken just as it is discovered. Although skirts may not proceed in orderly sequence to an era of loops and crinolines, the importance of the discovery of fashion cycles will not be nullified. There will still be available a valuable contribution to the study of fashion and a method for measuring and evaluating fashion phenomena as they occur.

LILLIAN FREIDMAN

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The Economics of Consumption, by Charles S. Wyand. New York: The Macmillan Company. 1937. xiii, 565 pp. \$3.50.

Two quotations from the preface offer the premise and purpose of this volume: "Conventional economics posits the existence of demand and lets it go at that. When something goes wrong with this factor . . . attention [is] turned to an assiduous analysis of the production and exchange mechanism. . . . The present work attempts the organization of available materials and the formulation of a few tentative conclusions. . . ." It is this function of arranging and coordinating extensive information from myriad sources that offers the chief merit of this book, which should find its place as a text and reference volume in educational institutions.

The author experiences the usual initial difficulties in defining the consumer status and in relating it more significantly to economic theory; and displays a zeal on behalf of the welfare of the consumer, culminating in the prediction of an impending era in which the business profit motive may yield to a service motive, largely through the impetus of consumer awareness and belligerency. But, as a whole, the book earns the gratitude of the reader for the arduous and painstaking tracing of sources, assembly of materials, and the classifying of inferences and of relationships.

Possibly the topic most grievously neglected, and doubtless the most difficult of adequate analysis, is the field of consumer finance. A discussion of instalment sales is included in a chapter on "Commercial Manipulation of Choice," largely from the viewpoint of misuse and the high cost to the consumer; the larger field of credit and loans is insufficiently explored in its relation to consumer welfare and economic function.

The book is divided into four parts. The first is an introductory stage-setting. In the second part, entitled "The Consumer and His Function," the economic and psychological bases of consumer choice are delineated. In Part Three, "The Determinants of Choice," the author delves into biological, physical, anthropological, sociological, psychological, and economic aspects of the problem. Many of these chapters are fragmentary and involved; the summaries of economic factors, of commercial manipulation and of Government activities are most satisfactorily developed. In the final part, four chapters discuss "The Planes of Consumption," including standards and norms of living and the responsibility of the consumer for solution of the involved problems.

JOHN H. COVER

The University of Chicago

Economic Development of Germany under National Socialism, by Vaso Tripanovitch. New York: National Industrial Conference Board, Inc. N.I.C.B. Studies Number 236. June, 1937. xvii, 141 pp. \$3.50.

We have here an extraordinarily valuable summary statement of the economic balance sheet of National Socialist Germany at the end of 1936.

There exists no better analysis of the developments on the economic front in Germany from 1929 to 1936 than is provided by this little book. Chapters cover the organization of labor and industry, the economic position of German labor, the position of industry, the balance of international payments, foreign trade and the standard of living, and public finance. There is an excellent foreword by Virgil Jordan, President of the National Industrial Conference Board, and a most succinct summary of the whole book which precedes the formal chapters. Almost every chapter is also summarized, so that, in addition to being very compact originally, the book enables the reader to get a statistical picture of Germany in two other degrees of concentration. Although statistical tables are included, they have been thoroughly "digested" in the text, so that there is a very readable account available besides the statistics themselves. The book is an outstanding example of the principle that it is possible for an author to write a comprehensive economic or statistical work without competing with *Anthony Adverse* or *Gone with the Wind* in volume.

The author first states the general philosophy and policy of the National Socialist government toward industry and labor. "The theory of National Socialism is that the only employer in Germany is the German state and that no private interest is sacred if it conflicts with the interest of the nation as a whole. What is or is not in the interest of the nation is determined by the government; that is, by the National-Socialist party. Neither the employers nor the workers can refuse to carry out an order of the state, no matter how contrary it may be to their individual interests." National Socialism does not permit collective bargaining. Employees cannot refuse to obey decisions of the employer, but they can appeal to the "labor trustee" who is a governmental official. The labor trustee can not only change a decision of the employer, but he can, under certain circumstances, even dismiss the employer from his position of head of his enterprise.

Mr. Trivanovitch shows that production has risen substantially above pre-depression levels and that unemployment has been practically eliminated. He finds, however, that there has been no increase in wage rates, no boom in commodity and security prices and, what is very significant, no large dividend disbursements. National income has notably increased, and there has been a large increase in consumption. Business revival the author believes to have been brought about by government expenditures on public works and rearmaments. The large increases in business activity and in employment have resulted in materially increased tax collections and in a sharp contraction in expenditures for unemployment relief. Consequently, Mr. Trivanovitch does not believe that the present burden of governmental indebtedness is of alarming size. He estimates the public debt of Germany on March, 31, 1937, as between 37 and 38 billion RM, which would be an increase of about 10 billion RM since Hitler came to power. He concludes, "the size of the total debt is not excessive for a country of Germany's economic power. Consolidation of the short-term debt is not likely to cause any

embarrassment for the government because of its political powers of control and persuasion."

CALVIN B. HOOVER

Duke University

The Economics of the Iron and Steel Industry, by Carroll R. Daugherty, Melvin G. de Chazeau, and Samuel S. Stratton. New York: McGraw-Hill Book Company, Inc. Publication of the Bureau of Business Research, University of Pittsburgh. (Monograph Number 6.) 1937. Volumes I and II, xxxiii, xx, 1188 pp. \$12.00.

These massive volumes, containing the report of a special staff retained by the Bureau of Business Research of the University of Pittsburgh to study the operation of the iron and steel industry under its Code of Fair Competition, undoubtedly constitute the most comprehensive and painstaking economic analysis of this industry that has yet been published. Although this work cannot, in all honesty, be recommended as light reading for an idle week-end, the interested student will find the material carefully organized and well written, systematically outlined in the table of contents, and adequately indexed. Moreover, for the reader who is in a hurry, almost every section and chapter concludes with a brief summary, while the first of the two final chapters is devoted to a summary of the findings of the entire study.

The three authors are individually responsible for separate parts of the report: Dr. Daugherty for the wage and labor sections and for the recommendations on labor problems; Dr. de Chazeau for the study of distribution and trade and of pricing practices; Dr. Stratton for the chapters on production and on costs and earnings; and the two last-named jointly for recommendations on pricing problems. In spite of this division of labor among the authors, the report as a whole gives a detailed but coherent and unified picture of the economic organization of the industry and of its functioning under the code. The study, however, is by no means limited to the operations of the industry under the NRA. Based in part on trends in its development over the past decade or so, the descriptive and analytical material will undoubtedly be timely for many years to come. Changes in the steel industry rarely come overnight.

The authors, happily, were not content with mere description and analysis. Whether or not one may agree with their interpretations and conclusions—and this reviewer, at least, is unable to accept some of them—the authors of the report cannot be accused of having run away from a fight. The industry's "code of fair competition" is handled without gloves, e.g., "the Steel Code exemplifies industrial self-government in practically unfettered form. . . The checks imposed on that body were entirely inadequate to secure proper protection and control," and, further, "The fundamental theory that, in return for certain minimum wage and hour standards and

for the expectation that employment may be increased and that the bargaining position of labor may be improved, an industry may be permitted to determine its own 'fair trade practices,' to determine its own pricing mechanism, and to enforce its determinations with prohibitive fines collectible at law under contract is contrary to all experience and inconsistent with all democratic precepts."

The adoption of the Code did accomplish one of the main objectives of the NRA, the improvement of labor conditions by raising wages and shortening hours, albeit Dr. Daugherty concludes that the increases in wage rates "were more than offset" by higher prices and by "decreases in other elements of total costs per unit of product." With respect to the collective bargaining features of the Code, however, Dr. Daugherty says, "the Government labor boards, faced with weak unions and with obdurate, powerful anti-union employers standing on their constitutional rights, failed, in spite of notable attempts, to resolve the major issues of collective bargaining and union recognition."

But in the field of price control the administration of the Code reached heights of efficiency rarely attained in this imperfect world. Price cutting, which has always been regarded as a dishonorable act in this gentlemanly industry, rose almost to the proportions of a capital crime. Not only was the basing point system legalized and extended, but chisellers who dared to make price concessions not specifically approved in the Code were faced with punishment in the form of "liquidated damages of \$10 per ton of product sold contrary to the price, terms, or conditions provided in the Code or promulgated by the Code Authority pursuant to its terms." Needless to say, with the Code Authority clothed with almost unlimited powers as lawmaker, policeman and judge, "Price stabilization, in so far as it may be attained through price control, was probably more adequately provided for in the Code than at any other time in the history of the steel industry."

The authors, it is unnecessary to add, find little to commend in the administration of the Steel Code under the NRA. Faced with an almost unlimited opportunity to "analyze and devise a solution" for the industry's problems, the Code Authority interpreted its function as "nothing more than the maintenance of price control, and it performed this function with little regard for the vested rights or economic interests of minority parties . . . In short, it is inaccurate to describe the Code Authority's activities as comprising the determination of fair trade practices . . . Rather it devised and promulgated, with the force of law, trade practices, fair or unfair, that would effectively block price competition in the sale of Code products at the ultimate place of delivery."

After all this, one would not be surprised to find the authors advocating, with the Federal Trade Commission, that "competition should be enforced" in the industry by uprooting such monopolistic practices as the basing-point system and enforcing an f.o.b. mill price quotation system. On the contrary they find that such "ineradicable economic factors" as the small

number of sellers in the industry, the large capital investment and consequent importance of overhead costs, the lack of mobility in sources of supply and the inelasticity of demand, all "preclude a simple competitive price for steel." Anything approaching pure competition, in their judgment, would be "incompatible with the economics of the industry," "destructive of the long-run interest of all parties concerned," "ruinous," and "undesirable," "economically unattainable in the steel industry." In short, "the tonnage steel industry represents a problem in monopoly . . . an economic structure inherently monopolistic" and one in which "a fair price for steel and the elimination of preventable social waste can be assured under private ownership only if some form of social control can be made effective."

Space and time prevent an adequate presentation or appraisal of the authors' arguments for the preservation of the basing-point system and the adoption of some form of "social control" instead of an attempt to enforce price competition in an industry which everyone knows has always been characterized by "oligopoly," "price leadership," "collusion" and other monopolistic departures from the rarely attainable goal of "pure competition." This reviewer, for one, remains unpersuaded that some other form of social control (for, after all, governmental enforcement of competition is a form of social control) would be more effective in promoting the interests of "all parties concerned," than an attempt to enforce price competition in the industry.

After all, what do we mean by "cut-throat competition," by "ruinous prices," by "destructive price-cutting?" Whose throat is cut? Who is ruined or destroyed by price competition? What happens when the worst happens, and a physically efficient enterprise goes through receivership? Ownership changes, some of the security holders lose money, a new set of managers comes on the scene; but the show goes on; the physical equipment remains intact and continues to employ labor in turning out the products that society needs. The competitive system of private enterprise is something less than a profit system; it is a profit *and loss* system and if we insist on mutualizing the losses we must also insist on mutualizing the profits. And the authors of this study envisage this possibility. "Social control," they say, "may take many forms—industrial self-government with public supervision and appeal to some important body, government competition, complete socialization of the industry, or merely the accumulation and publication of factual data adequate to appraise the social and economic effects of industrial policies."

These four alternatives, in the judgment of this reviewer, leave a good deal to be desired. Certainly one would be naive to suppose that the mere "publication of factual data" would bring socially beneficial results. Industrial self-government under public supervision would lead inevitably to government price- and wage-fixing, to regulation of the industry as a public utility. And to resort to government competition would mean merely that other means of social control—apart from the last resort of complete sociali-

zation—had proved ineffectual. And, after all, if enforced private competition would have such dire effects on all parties concerned, is it likely that government competition would be socially beneficial? But perhaps, to paraphrase Mark Twain, the trouble with competition is that we haven't tried it yet. And if we do we may find that a pricing system which appears to be incompatible with the economics of the steel industry is in reality only incompatible with the interests of the steel producers.

J. FREDERIC DEWHURST

The Twentieth Century Fund

Location Theory and the Shoe and Leather Industries, by Edgar M. Hoover, Jr. Cambridge, Massachusetts: Harvard University Press. 1937. Harvard Economic Studies, Volume LV. xvii, 323 pp. \$3.50.

As the title indicates, this study treats the history and development of the American shoe and leather industries as well as various problems in these industries which bear on the principles governing the location of economic activity, especially of manufacturing establishments.

In the historical sections there are detailed accounts of the several economic, social, and geographic considerations which affected the location of the two industries from Colonial times to the present. In leather production, early factories were small and widespread, and their location was determined primarily by availability of hemlock or oak bark. Later, the use of bark extracts or inorganic materials resulted in the dominance of a new locational factor, access to hide supply. Factories became larger and tended to concentrate either around packing centers, where cattle and calf hides were plentiful, or along the Middle Atlantic coast, where imported goatskin and sheepskin were available. Nearness to materials has been paramount.

Shoe production, on the other hand, has been oriented to markets or to labor supply. Despite the westward shift of population during the first half of the nineteenth century, Massachusetts and the Middle Atlantic states retained leadership, mainly because of the possession of skilled labor and plentiful capital for merchandising. Just prior to the Civil War the immigration of skilled German workers facilitated the westward development of the industry. In 1860 the introduction of the McKay sewing machine reduced the requirements of labor skill, and the leasing of machinery favored small western producers by keeping down capital requirements. More recently, the importance of style changes in shoes, with the resulting emphasis on speed of delivery and close contact between production and merchandising, has favored location in a metropolitan area. Higher costs resulting from organization of labor have favored suburban location and, in the past few years, have stimulated shoe production in the South. The apparent similarity in the locational patterns of tanning and shoemaking, in the opinion of the author, is largely coincidental.

In the sections on locational theory, Professor Hoover builds upon the

theory of orientation of Alfred Weber. If the distribution of natural resources and markets is taken as given, the location of extractive industries is determined by transportation costs. With the location of these industries set, it is shown that transportation costs also define the location of manufacturing industries, which, according to the nature of the productive process or of market demand, are material-oriented, market-oriented, or simply scattered between markets and materials. With Weber's theory the author combines a theory of market areas or spatial competition. He then introduces the effects on locational theory of differences in cost of production, mainly labor-cost differentials, and of economics of concentration. Although the theory of location still remains far from complete, the author's analysis helps explain many phases of the problem. More of the assumptions need to be studied. What would follow, for example, if the distribution of materials, markets, and population was no longer assumed as given? Further study is needed of the effects of size and density of a population on the division of labor, the extent of external economics, and the development of related industries. In his final chapter the author discusses phases of the theory of location which, if analyzed, would throw light on problems of monopolistic competition and of public policy relating to location of industries and people.

GLENN E. McLAUGHLIN

University of Pittsburgh

Problems in Labor Relations, A Case Book Presenting Some Major Issues in the Relations of Labor, Capital, and Government, by Herman Feldman. New York: The Macmillan Company. 1937. xxxix, 353 pp. \$2.75.

The conviction underlying this book of approximately 400 cases in labor relations, combined into 70 major problems, is that "the problem method is peculiarly necessary in the teaching of labor relations. One of the troubles in this field is that too much is taught in terms of generalities of economic and social principles . . . and that too little is considered with reference to the ways in which human nature expresses itself in actual situations." Although the book is designed in part for courses involving professional training for labor administration or graduate work in labor relations, the author states that "it has more particularly had in view introductory courses in labor problems conducted in accordance with the modern techniques being developed in progressive teaching." An underlying hypothesis seems to be the belief, expressed by Professor Elton Mayo and quoted by the author, that "labor problems involve human and social, rather than economic, problems."

Such a book necessarily has to be evaluated from the point of view of pedagogy in the field of labor problems rather than in terms of the standards or criteria to which reviewers—particularly those not certain that the economic aspects of the problems are inherently less weighty than the "human and social" ones—might subject other labor books. Disputation among teachers

as to whether the problem method, with its almost inevitable emphasis upon the firm's or industry's viewpoint, is superior to the more customary forms of instruction is inevitable. But such disputation will be conducive to wholesome soul-searching on the part of the disputants; and even those most skeptical about the efficacy of the case method in the labor field must acknowledge the skill with which the work under review has been done. Professor Feldman's cases, drawn for the most part from actual experience, are grouped together under five main headings: wage problems; hours, working conditions, and labor legislation; old age, insecurity, and unemployment; the personal environment of work; and group relations, unions, and labor law. The cases are intended to be provocative, and almost invariably they are. They cover a wide range, and the difficult task of suggesting to the student those aspects and implications of the problems that lie beyond the concrete situation presented to him has been accomplished, it seems to the reviewer, even more successfully than one could in fairness demand.

Teaching labor problems by the case method of course involves dangers. Confronted with a definite situation requiring administrative decision, the student is likely to consider the problem almost exclusively in terms of this situation, perhaps to get into the snap-judgment habit, and to be more or less oblivious to the need for analysis of the underlying legal, economic, and social determinants of the problem. Certainly greater responsibility rests upon the instructor than under the more traditional methods of teaching. As the author observes, however, the cases can—and indeed should—be supplemented by other materials and means of study. It is true that some of the cases “go better” than do others, for the reason that their subject matter is more susceptible to presentation in terms of concrete situations requiring entrepreneurial decision. In the wage section, the problems of wage incentives, administrative problems, time setting, and the like lend themselves to this method more easily than do the more theoretical issues. Problems of supervision, discipline, suggestions, and employee grievances can be handled more effectively by the case method than can, say, the economics of the shorter working week or the issue of wage rate maintenance during depressions. The section on group relations and unions, it should be said, brings out most adroitly some of the knotty issues connected with the question of what constitutes bargaining in good faith, the ascertaining of the workers' choice of representation, and the majority vs. the proportional rule. The book deserves a cordial reception.

ROYAL E. MONTGOMERY

Cornell University

Urban Workers on Relief, by Gladys L. Palmer and Katherine D. Wood. Washington, D.C.: Works Progress Administration, Division of Social Research. 1936. Part I, xxvii, 203 pp. Part II, xx, 301 pp.

These two monographs embody the findings of a survey of urban workers on relief in May, 1934. The time was well chosen, inasmuch as it fell between

the peak of unemployment and the peak of relief. The basic social and economic information about families on urban relief rolls was collected to answer certain specific questions for the Federal Emergency Relief Administration in order to determine the future direction of the policies of the Federal Government in providing relief. Presumably, this purpose has been served, and any review of the monographs would be concerned with, first, whether the findings as presented represent an accurate interpretation of data and, second, whether the data as presented will be of general use to social scientists.

The study was based upon a sample of the relief loads of 79 urban centers which were widely distributed geographically and which represent a wide variety of economic and industrial backgrounds of American industrial communities. It is unfortunate that in the presentation the authors have not gone into more detail as to the basis upon which the sample was made. It is necessary to rely upon their statement that the data "may be said to be reasonably representative."

A most significant finding of the study was the large per cent of families on relief in which there was no employable member. Although this is no new or startling fact, yet there is considerable value in bringing the subject home with an impressive array of statistical data. In presenting this situation the authors do not seem to be as clear as they might in their definition of the so-called unemployable, which of necessity is a very vague term subject to considerable disagreement as to its precise meaning. A large number of unemployable individuals, then as well as now, are almost certainly permanently unemployed. To designate them as unemployables, however, would hardly seem to be sound terminology unless the term "unemployable" is so defined.

In the findings, considerable emphasis is placed upon the description of a typically unemployed person and the average unemployed woman on relief. These concepts, while they may be effective in attracting attention to the study, have practically no meaning in a scientific sense. In fact, the authors in their text elaborate on the fact that the relief rolls of the country are greatly conditioned by the variety of different local practices and policies. Consequently, the total relief roll is by no means a homogeneous universe from which to draw a sample.

In the main, the analysis of the data, which is relatively slight in proportion to the mass of tables and charts, is a very good one. For the most part it is purely descriptive and easily read and assimilated. There is a criticism to be made with regard to the various charts scattered throughout the text. Since most of them are designed to convey a visual impression rather than to give statistical information, they should contain references to those tables of data upon which they are based. The pictographs seem wholly out of place and add nothing to the value of the document.

The second volume presents the detailed information by individual cities and should supply localities with valuable data on their respective com-

munities. A certain caution must be noted, however, with regard to using the data for intercity comparison. In the first volume the authors point out the great variety of conditions, such as the local administrative policies and procedures, the variety of local organizations dispensing relief funds, and the existence of strikes in some of the communities, which would materially affect the local character of the relief load at a given time. Although the authors have felt that these factors are relatively unimportant in describing the urban relief population as a whole, they recognize that they have a significant bearing on the analysis of the unemployment relief problem of any particular city. Therefore, any community using the data in Volume II in comparing their community with other communities would have to supplement the information in the monograph with a great deal of additional background material.

RALPH CARR FLETCHER

Bureau of Social Research
Federation of Social Agencies
of Pittsburgh and Allegheny County

Economic Backgrounds of the Relief Problem, by J. P. Watson. Publication of the Bureau of Business Research, University of Pittsburgh. (Monograph Number 5.) 1937. \$2.00.

The suddenness with which relief for the unemployed burst upon the national scene in 1933, and the amazing magnitude of its operations since that time, have almost literally buried the research worker under a bewildering mass of social and economic data. And the end is not yet in sight—indeed, the avalanche gathers force with each new study and program. The analyst, harassed by insistent demands for results and keenly aware that today's conclusions may be contradicted by tomorrow's development, grimly hacks his way deeper into the maze.

Slowly, and somewhat haltingly, the results of these efforts have begun to appear, and they are welcome. For these scattered reports and exploratory analyses contain the facts that eventually will form a broad base of knowledge about relief and unemployment which is essential to sound planning of a comprehensive public assistance program.

Dr. Watson has done a service in bringing together in his monograph a wide variety of facts, estimates, and inferences concerning employment and unemployment in Pittsburgh and Allegheny County. For his facts he has drawn heavily on the Fifteenth Census of Population, the concurrent Census of Unemployment, the Census of Employable Workers in Urban and Rural Non-farm Areas, Pennsylvania, 1934, and the compilations of the Bureau of Business Research, University of Pittsburgh.

Depending largely upon materials drawn from these sources, Dr. Watson embarks on the ambitious investigation announced in the title of his monograph, and immediately he is in difficulties from which he extricates himself

only occasionally. The chief difficulty appears to be that of building a bridge from the data to the stated purpose of the investigation, i.e., "an exploration in the probability of need," that will stand up under the heavy traffic it is made to bear. Unfortunately, the data differ enough either as to time or definition to require repeated estimates, adjustments, and assumptions. Perhaps for this reason Dr. Watson appears to be undecided in his introduction as to the best line of approach; and the reader confronted in the first eight chapters with theory and fact that are put together but are never integrated.

In the ninth chapter entitled "Irregularity in Opportunity For Employment In The Pittsburgh District" Dr. Watson suddenly reached solid ground, and presents an extremely forceful and interesting analysis of the rate of growth of business activity based upon a well integrated body of information. Again in the last chapter, which discusses social policy towards relief, Dr. Watson shakes off the difficulties that beset much of the work and presents some shrewd observations.

In addition to the specific information, this study is valuable in that it reveals some of the difficulties that confront the analyst who makes an excursion into what is, in effect, a new field. Given descriptive data on employment and unemployment, how is the analyst to evaluate the "probability of need" in terms of the organization and operation of our economy? Logically, the first step would be to derive a rationale of analysis from the mature body of theory and fact on the subject. But when the social analyst turns to economic theory for a point of departure into the field of unemployment, he finds the cupboard is pathetically bare. The kind of unemployment that gives rise to the problem of relief is simply not in the books of the theoretical economists who have laid the groundwork of our approach to economic problems.

Apparently, Dr. Watson was fully aware of this lack, for in his first four chapters he attempts to set up guiding principles in terms of the central concept of need: "Need, as it concerns us here, means not enough goods and services *before* relief is provided. Of its total extent, there is no record." (Page 4.)

Now it is one thing to argue that unemployment statistics provide a rough measure of need in the sense of a faulty working of the productive and distributional processes, and it is an entirely different thing to argue that these statistics provide a measure of need in the sense of relief. Obviously, relief-need is directly related to unemployment-need, but as yet no one has been able to show the extent and conditions of this relationship.

Between these two concepts of need—non-participation in the productive-distributive process, and involuntary destitution—Dr. Watson wavers, but on the whole he seems to prefer the former. Among his statistics of unemployment the reader will find none of the unemployment relief series that do indicate, however inadequately, the magnitude of distress unemployment.

It seems clear from this work that a full account of the economic back-

grounds of the relief problem will require a thorough overhauling of our thinking about employment, unemployment, the labor supply, and the labor market. By demonstrating the inadequacy of our present concepts, Dr. Watson's book is a step in this direction, and it should be evaluated in those terms.

JOHN N. WEBB

Works Progress Administration

Die Grossstädte im Ströme der Binnenwanderung, Wirtschafts- und bevölkerungswissenschaftliche Untersuchungen über Wanderung und Mobilität in deutschen Städten, by Rudolf Heberle and Fritz Meyer. Leipzig: S. Hirzel. 1937. xi, 206 pp.

This analysis of the official data from the police registration system in Germany is intended partly as a contribution to a systematic social economic theory of migration and partly as a contribution to the information necessary for the new social planning in Germany. The basic problem is to determine the relation of internal migration to and from large cities to (1) the business cycle and (2) the economic and social structure of the cities, and to a less extent to the structure of the areas from which these cities recruit their migrants. Part 1 is primarily a summary statement of available knowledge concerning internal migration with reference to urbanization and an interpretation of the findings of this study. Part 2 is a detailed analysis of the reports of the German police registration system.

In the main, the analysis utilizes the total volume of migration, i.e., the sum of the migrations to and from an area during a specified period of time. For most purposes the total volume of migrations is a better measure than the more commonly used figures showing net gain or loss.

The subjects investigated include (1) the relation of the total volume of migration to the net result of those migrations and the relations of both to changes in business conditions and industrial organization; (2) the relation of the rate of mobility to the economic and social structure of the city, which is the focus of the migrations and of the areas from which the migrants come; (3) the rates of mobility for cities representing different types of industrial organization and various stages of the growth cycle; (4) the degree to which the mobility of the several occupational groups reacts to changes in business conditions; (5) seasonal fluctuations in the volume of migrations; and age, sex, and marital status of migrants.

Only a few of the major findings can be mentioned here. The total volume of migration in the postwar years is considerably less than in the prewar years. The volume of migration from cities generally increases in periods of prosperity and decreases in periods of depression. Losses by migration are primarily due to a greater decrease in in-migration than in out-migration, although an increase in out-migration relative to in-migration may sometimes be responsible for a net loss by migration. With increasing maturity

of the industrial organization and with increasing urbanization the proportion of intercity movements increases in relation to that of rural-urban migrations. The former show less marked seasonal fluctuations than do the latter. The several occupational groups have varying mobility rates, and the mobility of the unskilled group reacts most directly to fluctuations in the business cycle. The extremely large mobility rates for some unskilled groups are due to repeated migrations of the same individuals during specified periods of time. The relationship of rural-urban migration to fertility rates is complex—it is certain that the cessation of rural-urban migration would not necessarily lead to an increase in the birth rate of the total population.

The limitations of this study are largely inherent in the nature of the data used. The emphasis is primarily on acts of migration rather than on migrants. The available data for in- and out-migrations do not permit a ready count of the total unduplicated number of individuals involved. A large proportion of the migrants to a city remain there only a short time, as is shown clearly in the section of this study dealing with seasonal migration. The large amount of duplication involved when figures for in- and out-migrants are combined is a factor of some importance in describing the individual characteristics of migrants, such as age. For the major portion of the study, however, this distinction is of less importance.

The authors do not claim to have written a comprehensive treatise on internal migration. For instance, there is no analysis of the relation between internal migration and the optimum location of population with reference to economic opportunity, and non-economic factors in migration are scarcely mentioned. This limitation may also be responsible for the failure to analyze the relationship between urban rates of natural increase and migration. They do claim, with justice, to have made an exhaustive use of the available data for the aspects of the subject considered. Careful technical treatment has been combined with well-developed theoretical analysis and clarity of presentation. This book is certain to occupy a leading position in the rapidly growing literature on internal migration.

CONRAD TAEUBER

Bureau of Agricultural Economics
United States Department of Agriculture

Studies in Current Tax Problems, under the direction of Carl Shoup. New York: Prepared in Connection with a Survey of Taxation in the United States under the Direction of The Twentieth Century Fund. 1937. xxiii, 303 pp. \$3.50.

The present volume supplements an earlier study of the Twentieth Century Fund, also under the direction of Carl Shoup, and supplies some of the preliminary data and methods of analysis that were employed by members of the research staff. The studies include estimates of the Federal, state, and local taxes paid by different income classes in New York and

Illinois, a comparison of the aggregate burden of Federal and state income taxes in eleven states, a compilation of state property tax rates, a study of the costs of administering various state and local taxes, the methods followed in estimating the yield of income and estate taxes, an estimate of Federal, state, and local expenditures for the period 1936-40, and a list of recent studies of state and local tax systems.

The field of taxation is largely a dark continent with vast unexplored areas. Studies such as these shed much needed light on subjects where information has been lacking because of inadequate statistics and the unavailability of statistical techniques by which the far-reaching and intangible results of taxation may be determined more accurately and solutions for difficult problems in tax administration and tax policy may be found. The present volume is welcomed as an application of statistical analysis to the problems of taxation. Much more work remains to be done in this direction, but the volume marks progress along a desirable trend. There are, no doubt, differences of opinion concerning the proper techniques of statistical analysis and their importance in the field of taxation, but it is significant that taxation is being studied with the aid of statistical devices which enable research workers to formulate conclusions more accurately in many instances.

To many readers the most interesting part of the book will be the first section, comprising a study by Mabel Newcomer, in which estimates are made of the taxes paid by different income classes in New York and Illinois on the basis of various assumptions concerning the shifting of Federal, state, and local taxes. The estimates are admittedly rough and apply to certain family types rather than to particular families. The data support the conclusions that property and commodity taxes are regressive in their burdens, that the progressive element in American taxation results from the collection of progressive income and death taxes, and that the tax burden among the income groups is, "on the whole, progressive." It is concluded that the taxation of the population not subject to income and death taxation, however, is regressive in burden, whereas the taxation of the classes paying income and death taxes is progressive in burden.

The study illustrates the difficulties arising when an effort is made to measure individual and class tax burdens as long as so little is known about the incidence of taxes. On the basis of particular assumptions certain conclusions may be drawn, but in many cases it is not known which assumptions best fit the facts of tax shifting. The authors of the two tax studies of the Twentieth Century Fund have not essayed the difficult task of showing precisely how taxation should progress in its burdens so that the maximum justice may be attained but have recommended a number of significant reforms. Ability to pay is still an indefinite standard of tax justice, but eventually it may be possible to formulate and apply this principle more satisfactorily.

The volume gives much information that will be useful in the interpreta-

tion of the conclusions reached in the earlier report and in the development of techniques of statistical analysis of the incidence and effects of taxation, the costs of tax administration, and other problems. Although many perplexing questions concerning taxation must remain unanswered for the present, at least, it is encouraging to have available the results of competent research in taxation of a number of tax authorities.

ALFRED G. BUEHLER

University of Vermont

International Short-Term Capital Movements, by Charles Poor Kindleberger.
New York: Columbia University Press. 1937. xi, 262 pp. \$3.00.

The scope of this book is considerably broader than its title suggests. Dr. Kindleberger has sought to provide a theoretical analysis of the structure of international monetary relationships better adapted than the oversimplified doctrines contained in older treatises to penetrating the extraordinary complexity of current developments and problems in this field. His interest lies not so much in building up a case for or against any particular kind of monetary standard or policy as in setting forth the relationships between the national money income, the balance of payments and the rate of exchange.

The study is divided into four parts, of which the first deals with the effects of international movements of short-term funds upon the money supply and the national income, pointing out in detail how such movements may take the place of gold flows not only in balancing the balance of payments but also in their effects on national money income. In part two the transfer mechanism is described under assumptions of both fixed and flexible exchanges. It is shown that when exchange rates are fixed, adjustment takes place through the effects of movements in national money income on the demand for foreign trade goods and that the degree to which changes in money income are called for by the adjustment process is dependent upon what Dr. Kindleberger terms the flexibility (i.e., income elasticity) of demand for foreign trade goods. Under a system where fluctuations in exchange rates take the place of transfers of gold and short-term funds, adjustment comes about more largely through the effect of exchange rate movements upon the relative prices of domestic goods and foreign trade goods, thus producing the needed changes in real income without necessitating changes in money income. Part three of Dr. Kindleberger's study deals with several topics which are only loosely connected, of which the chapter on foreign exchange equilibrium is probably of greatest interest. In this chapter he shows that the equilibrium rate of exchange is determined by two groups of factors: the monetary factors as reflected in the relative level of incomes and prices, and the real factors as reflected in the substantive course of trade and capital between countries. The exchange rate is in equilibrium, at least momentarily, when the balance of payments is tending neither to increase

nor to decrease the national money income, and this will be the case if such gold flows as are occurring merely offset movements of short-term capital. In part four the author applies the analytical apparatus developed in the earlier sections of his book to the problem of internal stability in an open economy and for such an economy suggests that changes in money incomes in other countries or in the substantive course of trade and capital are bound to have domestic repercussions, though the form and extent of these repercussions are dependent in part upon the type of currency standard and monetary policy in effect. A chapter is devoted to a discussion of the forward exchange market and another to stabilization fund operations. Some useful suggestions regarding the use and interpretation of the capital movement statistics published by the United States Treasury Department are contained in an appendix.

Dr. Kindleberger's treatment of the role of short-term capital movements, the transfer mechanism, and foreign exchange equilibrium represents a further extension of the theoretical approach to these problems developed by such writers as Angell, Ohlin, and Iversen. In the reviewer's judgment, this approach provides a much more accurate account of observed phenomena than the price-specie-flow analysis, with its tendency to minimize the significance of short-term capital transfers and of shifts in demand schedules as elements in the adjustment process and its dependence upon a particularly rigid version of the quantity theory of money. One of the chief merits of Dr. Kindleberger's book is that he does not succumb to the temptation to overstate his points as a means of emphasizing the contrast to earlier theories, as some other writers have done. Thus, he is careful to point out that not all movements of short-term funds are of the equalizing variety and to discuss the effects of other types of movements. He shows also that the relative effectiveness of short-term capital movements and gold movements in producing changes in national income depends partly on the laws, traditions, and policies governing the banking system and partly upon the whole economic environment. Finally, while stressing the importance of shifts in demand as part of the transfer process, he avoids the pitfall of holding that these shifts necessarily obviate the need for changes in terms of trade.

The theoretical structure set forth by Dr. Kindleberger rests in some measure upon a rather sharp conceptual distinction between short-term and long-term capital movements of a sort which it is exceedingly difficult to draw in practice. As he indicates, what matters for some purposes is not so much the type of asset involved but rather the transitoriness or permanence of the influences giving rise to the movement. Thus, for example, substantive factors may produce sustained, one-directional movements of capital which are short term in form, while transitory influences susceptible of possible early reversal may generate movements of apparently long-term capital. In the light of this consideration, Dr. Kindleberger's proposition that the existence of exchange rate equilibrium is revealed in the balance

of payments by an equality between gold flows and short-term capital movements loses much of its apparent simplicity and precision. Moreover, the proposition that when such equality exists, the balance of payments tends neither to increase nor to decrease the national money income implies a categorical distinction between long-term and short-term capital movements so far as their primary effects on money income are concerned, although the author elsewhere points out that the actual range of possibilities in this respect is extremely wide and that from this standpoint no hard and fast line can be drawn between these two types of movement. This criticism is not designed to minimize the importance of Dr Kindleberger's theoretical contribution, which, indeed, is substantial, but rather to suggest the difficulties which beset any attempt to give precision to concepts which are, perhaps, inherently nebulous.

EMILE DESPRES

New York City

The Undistributed Profits Tax, by M. Slade Kendrick. Washington, D.C.: The Brookings Institution, 1937. Pamphlet No. 20. 108 pp. 50 cents.

Analysis of replies from 1,560 industrial corporations to a questionnaire on the undistributed profits tax is the primary concern of this pamphlet. The imposition of the undistributed profits tax has introduced an economic controversy that demands prompt action, and Senator Steiwer (who sent out the questionnaires), the Brookings Institution, and the author are to be congratulated on undertaking to gather and analyze these factual data in a field where opinion has been supported largely by abstract reasoning and isolated cases

The questionnaire deals with (1) the corporations' reasons for accumulating reserves, (2) the extent to which their reserve and dividend policy has been modified by the tax, (3) desirable amendments to the present tax law, and (4) the opinion of corporation officials as to the consistency of the tax with sound business policy.

The reasons given for accumulating reserves (among which provision for lean years and for expansion rank first) emphasize the desirability of substantial reserves. Of more interest, however, are the effects of the tax on reserve and dividend policy in the first year of its operation. The tax stimulated the majority of the corporations (572 out of 684) to distribute a larger proportion of earnings than they would have distributed in the absence of such a tax. This was, of course, one of the objectives of the tax. It did not, however, influence the kind of dividends paid in most instances, nor did it change policies with regard to repayment of company obligations or reduction of the amount of capital deficits in the majority of cases. These are answers to some of the most urgent questions that those concerned with the desirability of the undistributed profits tax have been asking.

The answers to the questionnaire offer little light on the possibility of ob-

taining new capital by other means than the accumulation of surplus, although some of the comments of corporation officials on this problem are given, and the author has included in the study pertinent data from other sources, notably the Securities and Exchange Commission.

An important addition to the tabulation of the direct replies to the questions is the reproduction of well-chosen excerpts from the comments of different corporation officials concerning specific problems that their corporations have faced in consequence of the new tax. The net effect is to make a very forceful case for the repeal of the tax, from the business point of view; and it is not surprising to find that only 13 corporation officials out of 1,245 believe that the tax is consistent with sound business policies. Although certain amendments to the tax are strongly urged, it is apparent that this body of officials believes that the only real solution of their difficulties is repeal.

In this opinion Mr. Kendrick concurs. After considering and condemning the tax from the viewpoint of "economic justice" he states: "the conclusion reached is unequivocally that the tax should be repealed." The nature of the study is such as to preclude a balanced presentation of the advantages and disadvantages of the tax, but this in no way impairs its value as a document presenting both the business man's attitude toward the tax and the way in which the corporations have met the problem in its initial year.

MABEL NEWCOMER

Vassar College

Studies in Massachusetts Town Finance, by Eugene E. Oakes. Cambridge, Massachusetts: Harvard University Press. Harvard Economic Studies, Volume LVII. 1937. 237 pp. \$2.50.

This book is not a statistical study. For that reason it probably will not be read by many statisticians. Yet so much their loss, for the author has used an approach, the intensive case method, which some statisticians might well examine if only to foster an increased objectivity toward their own methodology.

Nine detailed studies in local finance and community economic history occupy the entire book, save for a brief introduction and a conclusion. The material abounds in figures, presented in tabular form; yet it is readable. The text shows the hand of a careful worker and of one who has mastered his tools and subject matter.

One may appreciate the merits of the case method and of this excellent application without, however, giving unqualified praise. The author voices a strong belief in the need for intensive case studies in public finance. Moreover, he has demonstrated skillfully that this approach will yield fruitful results. Yet this book probably will not go far toward encouraging others to go and do likewise. The reasons are not very obvious but they are there. The study has not been labeled as one in methodology. More basic, the introduction, or an appendix, might have been devoted to describing the whole

approach. A critical appraisal of source material, a record of successful steps and any blunderings and of the "hows and whys" would have encouraged others to explore the possibility of applying the same method to other phases of public finance.

Again, the author should have made more of an attempt to relate his results to problems which are common to local finance the country over. He knows the field and could have written with much broader pen-strokes. Such would have met the criticism that the case method unduly narrows the investigator's horizon. Unfortunately the introduction and the conclusion are too brief and inadequate for attaching to the results their full significance. An attempt in the right direction is made by linking these case studies with the broad problem of benefits versus tax burdens. But either the central theme is too general, or not sufficiently emphasized, or else the factual situations are not adequately integrated with this main theoretical consideration. It is difficult to decide which.

An important by-product of these nine cases is the concrete evidence which they offer as to how the changing character of a community's economic life affects the finances of the local government. Nor can one overlook the amount of useful, historical light which these case histories throw upon such current problems as the movement toward consolidation of local units, state-administered locally shared taxes, the effect of poor relief upon local finance, and the varying character of the poor relief problem in different types of communities. To mention only these ought to be sufficient to show that the contents of this book, as well as the method, are of more general significance than the title would suggest.

A. M. HILLHOUSE

Municipal Finance Officers' Association

Federal Subsidies to the Provincial Governments in Canada, by James A. Maxwell. Cambridge. Harvard University Press. 1937. Harvard Economic Studies, Volume LVI. xi, 284 pp. \$3.00.

In this interesting and valuable book Mr. Maxwell traces the history and judges the experience of Provincial subsidies in the Canadian federal system. Beginning with an examination of the politico-financial problems that beset the conventions and conferences in which the constitution of 1867 was hammered out, he describes the financial arrangements agreed upon and written into the British North America Act as "full settlement of all future demands." It is clear that the framers of the constitution believed that they had settled the question for all time. The next 175 pages show how even before the new constitution came into operation the demand for "better terms" was in full cry; how during the past 70 years the pressure for increased subsidies has never ceased; how a dozen separate and specific changes have been made, most of them in turn labelled "a final and unalterable settlement" of the subsidy question; and how the problem of subsidies and "better terms"

is as politically ubiquitous today as ever. The perennial demand has come with equal force from east and west, from the distressed areas of the Maritimes and the extravagantly optimistic prairies and Pacific Coast.

Mr. Maxwell's general conclusion is that Canadian experience amply justifies the orthodox view that unconditional subsidies are a bad thing, that the responsibilities of taxing and spending ought not to be separated, and that unconditional subsidies almost inevitably become inextricably involved with questions of party management and election manoeuvring. Mr. Maxwell recommends that the present subsidies be capitalized at a generously low rate and that the federal government take over provincial debts equal to these capitalized amounts, thus solving two problems at once—the "canker of subsidies" and the burden of provincial debts.

Some of the implications of this suggestion are not fully considered. Such a transfer of indebtedness would virtually extinguish the entire provincial debts of two provinces and would reduce the debts of most of the other provinces to levels which might invite such future borrowing as to produce just as serious a debt position 20 or 30 years hence. To forestall this by imposing rigid federal or collective control of provincial borrowing might be politically as difficult a problem as subsidies. The special position of Prince Edward Island is passed over too easily. In this case the capitalized subsidy is nearly five times the total provincial bonded indebtedness, and three times the total bonded indebtedness of the province and all its municipalities combined. Australian experience suggests that debt transfers will do nothing toward silencing the incessant demands of psychologically or economically depressed areas for new or larger subsidies. It is to be feared that Mr. Maxwell's proposal would be no more a final and unalterable settlement than any of the dozen others that have gone before. As part of a broad and comprehensive scheme of reallocating functions and taxing powers between Dominion and Provinces the suggestion has undoubted merits.

In a brief Part II of 50 pages, Canadian experience with conditional subsidies and grants-in-aid is examined. These devices have been tried in only a few cases. In the earlier experiments the schemes were vaguely conceived, ineffectively supervised, and probably did more harm than good. More recent attempts to use this device have been moderately successful, and we may expect its more extensive use in the future. The scope of the book does not include provincial-municipal grants-in-aid.

Broadly speaking, this book is more a study in politics than in economics. Little economic analysis is attempted; the problem of the relative incidence of the subsidy system compared with other means of meeting provincial financial needs is not examined; the rather highly regressive nature of the whole Canadian tax structure is not emphasized; the unwillingness of some of the provinces to use all the taxing powers they have receives little attention. It is often easier, and certainly more popular, for a provincial government to raid the federal treasury than to impose heavier taxation. For the benefit of the general reader, the problem of subsidies might with advantage

have been more adequately set against the broader background of the whole range of Dominion-Provincial relations. Mr. Maxwell has nevertheless given us a valuable survey of one important aspect of federal public finance. He has brought to this study not only an accurate knowledge of the history of these subsidies based on painstaking study of voluminous government reports and manuscript archives covering a period of 80 years but also a keen sense for and appreciation of the realities of Canadian politics. Notwithstanding its fullness of detail, the book is eminently readable. It is a notable contribution to the neglected field of Canadian public finance, a useful addition to the broader literature of federal politics and finance, and a most timely document for the consideration of the Royal Commission on Dominion-Provincial Relations which is now in the midst of its labours.

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Corporate Interest Payments 1921-1932, by Edward Douglass Burdick. Philadelphia. University of Pennsylvania. A thesis in economics presented to the faculty of the graduate school in partial fulfillment of the requirements for the degree of doctor of philosophy. 1936. 130 pp.

The author of this brief statistical investigation is at least making a beginning in the direction of testing the accuracy of the various theories of the business cycle that take much for granted in describing interest payments, interest rates, and the problems of debt in general. For the movement of interest payments he chooses the period 1921-32. In considering the cyclical aspect of the problem he takes the shorter period 1929-32 and also presents a comparison between 1921 and 1931. As Mr. Burdick candidly admits, there are many gaps in his material. Nevertheless, he feels that, on the basis of the evidence available, theorists have been taking much too much for granted in their broad generalizations in regard to interest payments. Students of theory might find it worth while to look over the statistical details of this study.

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THE FUNCTION OF DEPOSIT BANKING*

BY E. A. GOLDENWEISER, *Director*

Division of Research and Statistics

Board of Governors of the Federal Reserve System

DEPOSIT banking as we know it in the United States has two distinct functions. Banks are a part of the mechanism of capital formation, for they collect the savings of the community and place them in long-term investments. In the exercise of this function, however, banks are not the only or major agency. Their chief and unique function is the creation of deposits through the extension of credit, either in the form of loans or of investments. This is the principal specific duty of banks from the economic point of view because deposits are the country's principal medium of exchange.

There is a group that believes that the capital formation activities of banks on the one hand and their deposit creating function on the other should be separated. Mixing of the two functions, however, is neither the only thing nor the principal thing wrong with our banking system. Furthermore, there is no likelihood of bringing about such a separation for some time to come. For the present we must live with a department store type of banking and I will confine my remarks to the function of banks as they exist today.

GROWTH OF INVESTMENTS

Although deposit creation and capital formation have been the two principal functions of banks for many years, they have shown wide changes in their relative importance. Since 1900 demand deposits at all commercial banks in the country have increased from 4 to 28 billion dollars, a 7-fold increase. Time deposits increased from 1 to 16 billions, a 16-fold increase. The proportion of bank deposits in the form of time deposits, therefore, has gone up from 16 to 36 per cent. All of the time deposits of commercial banks are in investments and in addition they have placed about half of their demand deposits in investments. Investments of commercial banks, since 1900, have increased from 22 to

* Notes on an address at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 27, 1937.

60 per cent of total earning assets, while commercial loans have declined from 49 to 19 per cent. Investments of commercial banks are more than one-half again as large as their time deposits. Salvation of banks must be worked out with reference to these general tendencies.

INDIVIDUAL BANKS AND THE BANKING SYSTEM

In any discussion of the function of deposit banking it is necessary to separate the individual bank from banks as a whole. The individual bank does not create its own deposits, to any extent. It receives deposits in the form of cash or checks and then loans them or invests them. That's why a wise banker once said that you can tell a real banker by the fact that he considers deposits as an asset rather than a liability. To him deposits mean the funds intrusted to him by the public for the purpose of passing them on to others through loans or investments. If this were generally understood, it would clear up a lot of misconceptions. An understanding of this difference between the individual and the group is essential to an understanding of the functions of banks and their responsibilities.

THE INDIVIDUAL BANKER'S RESPONSIBILITY

Individual banks have three separate and distinct responsibilities, which I shall give in order of their importance. The first responsibility of banks is to their depositors. Banks must be prepared to pay in full the deposits that they hold for the public. The establishment of the Federal Deposit Insurance Corporation does not relieve banks of this responsibility. Deposit insurance is only an assurance to the public that the banks will discharge their responsibility to depositors, and deposit insurance could not succeed if the banks neglected this responsibility. Moreover, deposit insurance covers only deposits of \$5,000 or less.

Second to safety of deposits comes the responsibility of banks to their stockholders. Banks must endeavor to give shareholders a reasonable return on their capital invested in the bank. The third responsibility of banks is to their community. In order to continue functioning, banks must have the goodwill of their communities. They must be prepared to give the community the service it demands. They must finance local enterprises and perform the various types of services the locality requires. Banks that place all of their funds in safe short-term paper do not fail but neither do they deserve not to fail, for they are not performing the function of community service for which they are created. But banks as a rule do not do this. Most banks place their

funds locally within the limit of safety to the extent that there is a local demand. It is only surplus funds that banks place in balances with their correspondent or in short-term open-market stuff. Banks do this not because of any particular philanthropy. They do it because it is more profitable. Rates on local loans are higher.

In addition to these three general responsibilities of individual banks the large money market banks in the financial centers have a fourth responsibility which is of a national character and which smaller banks can not be expected to carry. Money market banks, as we were aware in the 1920's during the large growth in security loans, have a responsibility of preventing an undue expansion of loans of certain types. These banks must watch not only the growth in the aggregate of loans but also their character. It is not too much to ask that they be conducted with constant reference to broad national developments. But even these banks can be expected to look only at the expansion of certain types of credit. They can not be guided by the total volume of deposits. Concern over the increase or decrease in the volume of deposits is beyond the scope of their activities and responsibilities. It is the function of a Government body.

MONETARY RESPONSIBILITY

From the public point of view, as I have already said, the creation of deposits is the most important function of commercial banks. The volume of deposits must be regulated by national policies pursued by a Governmental body.

The regulation of the volume of deposits can be through influence on earning assets or on deposits themselves. Regulation of the quantity of deposits on the basis of loans and investments presents several difficulties that have not been worked out and there is no expectation of doing this in the immediate future. Loans and investments are in many ways, however, more interesting figures than deposits. They offer an indication of the way in which funds are being used and give clues as to the behaviour of banks and the business community.

Of the different proposals for improving the basis on which reserve requirements are determined, one of the most significant is that of basing requirements on velocity as well as the amount of deposits. This has been subject to detailed critical examination and presents great possibilities, but it also raises real difficulties. I do not mean to say that this proposal has been abandoned, but it is not on the immediate agenda.

A more extreme proposal is requiring reserves of 100 per cent, at

least against demand deposits. In this way complete control of the volume of money, as defined by the school of economists who favor such a proposal, would be in the hands of a Government agency. A germ of real truth as to the behaviour of our monetary mechanism is contained in this proposal, but in my opinion its claims are much too great because of the stress this proposal puts on volume of deposits, or money, whereas the ownership of money and the use to which it is put is fully as important as the volume itself. Although further study of this proposal may reveal how it could improve our present mechanism, it is not immediately feasible because of the many problems it raises.

Our present system is one of fractional reserve requirements equal to 3 per cent against time deposits and 7, 10, and 13 per cent against demand deposits depending upon the location of the bank. These fractional requirements can be doubled under the law, and since the middle of last year the Board has done this, which is as far as it can go. At the present time reserve requirements on demand deposits are as high as 26 per cent against demand deposits at central reserve city banks, and 20 and 14 at other groups of banks.

Fractional reserve requirements have one distinct advantage over 100 per cent requirements, in that the fractional reserves give the monetary authorities a leverage. A reduction of \$100,000,000 in reserves, for example, in the absence of borrowing requires a reduction of deposits by 6 times that amount, and conversely an increase of \$100,000,000 in reserves exerts pressure to expand deposits by \$600,000,000. This leverage has been reduced by the raising of reserve requirements by the Board of Governors. Before that action the ratio of expansion and contraction was 12 of deposits to 1 of reserves instead of 6 to 1. This leverage contributes to making the volume of deposits more responsive to management. Also it leaves more to the play of forces in the market place where supply and demand can come into adjustment. Since we are going to have fractional reserves for some time to come, we must find solutions to our problems within this framework, which will continue over the short run in which we all must live.

LIMITATIONS ON EXISTING POWERS

There is a limitation to attacking the problem through larger reserve requirements, for there is a limit to which banks will have their reserve requirements increased and still stay in the Federal Reserve System. Successful action along these lines is closely tied up with the unification of banking. But some solution will have to be found to this problem, which is the biggest problem today in the monetary system: how can

we effect the transfer into the banking system of the large volume of sterilized gold in a way that will not carry serious inflationary possibilities for the future?

Within such a system the Federal Reserve has a large responsibility to discharge. It has, or should have, sufficient power over the volume of reserves to meet this responsibility. The Federal Reserve has used up a considerable part of its power and in certain conditions would not have enough to handle the situation. Within its present powers the Reserve System can not handle a large gold inflow.

I have had the idea that a solution to this problem of control might be worked out by preventing banks in some way from utilizing reserve funds above a determined amount. There is no doubt that theoretically it would work if there were only one bank, but there are many difficulties in such a system, arising largely from interbank settlements. I feel this difficulty is not insoluble, and we may have to rely upon this scheme some time in the future if it can be developed in a workable way.

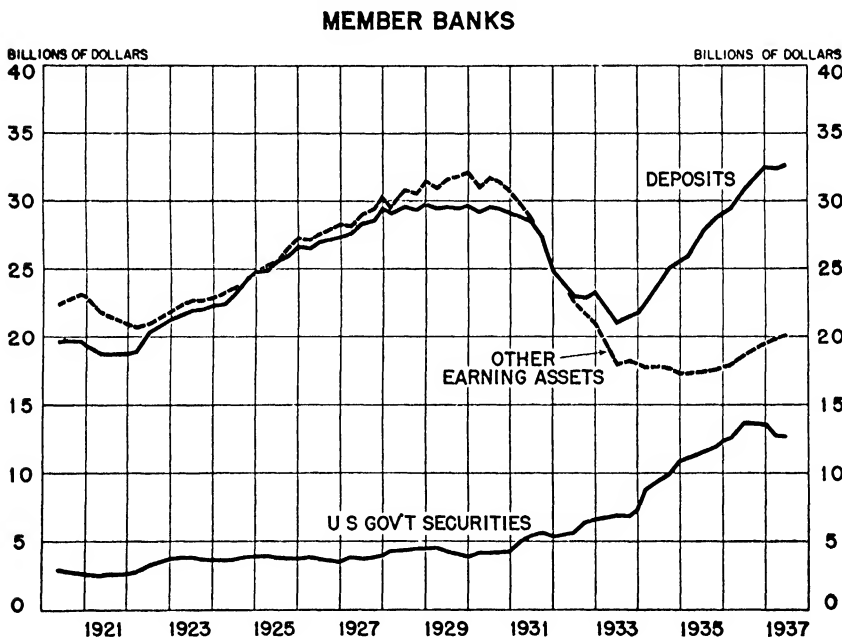
GOVERNMENT AND PRIVATE BORROWING FROM BANKS

I want to show you a chart I have had prepared which brings out in a striking way the altered condition of banks in recent years. The solid top line shows the volume of deposits in all member banks since 1920, the lower solid line gives United States Government securities held by banks, and the dash line represents all of their other earning assets exclusive of Governments. The chart shows that following a large growth of private loans and investments and a corresponding growth in deposits during the period of prosperity and speculative expansion in the 1920's, customers of banks rapidly paid off a part of their indebtedness when the break came and banks also liquidated investments. During the depression member bank loans and investments to business were cut nearly in half and the volume of deposits also declined sharply. Beside this contraction that of 1921 appears insignificant, although at that time it looked very big indeed. In the middle of this severe deflation the Government stepped in, sold securities to banks, and spent the proceeds in financing its relief and recovery program. Deposits began to increase rapidly and by the middle of 1936 the money supply of the country was restored.

You can look at the asset side and see the restoration of their volume through the addition of United States Government securities. You can see the creation of Government debt to take the place of reduced private debt. And debt, in our economy, is the obverse of wealth. Or you can look at the liability side and see the restoration of the money sup-

ply through the simultaneous creation of deposits. Or you can look beyond the balance sheet of the banks to the restoration of activity in Government enterprises to take the place of slackening private activity. Whichever way you look at it you will find the national economy restored to a more nearly normal condition by the intercedence of Government spending.

This restoration of the money supply was not necessarily planned as such. In a depression the Government is under the necessity to spend in excess of its income whether it wants to or not. At such times reve-



nues fall off even though expenditures do not increase, and in democracies at such times expenditures are bound to increase. Under these conditions the Government can finance itself by increasing taxes or by borrowing either from the public or from banks. If it could raise taxes and reach funds not in use, national income might be increased by just as much as it would be through an expansion of the money supply, since turning idle money into active money adds as much to the national income as does the creation of money. The same would be true if Government securities were sold to non-banking investors whose funds would otherwise remain idle. But it is not easy to devise taxes that would reach entirely or principally money that is not in use, and

other taxes are restrictive and harmful in a depression. It is also difficult, if not impossible, to tap investment funds that would be sure to remain idle if they were not invested in Government obligations. In addition to borrowing and taxing, the Government can print paper money to meet expenses, but this has obvious disadvantages, which are mentioned a little later. Borrowing from the banks is not only relatively easy at a time when they are eager for earning assets, but has the additional advantage of creating deposits to make up for the preceding decline. This chart is significant because it brings out in a simple way the whole idea of what the Government has done in the monetary field.

CRITICISMS OF BANK HOLDINGS OF GOVERNMENTS

The sale of Government bonds to finance the Federal deficit has at various times been criticized by some bankers because, as they said, banks should not be loaded with the burden of Government securities. I never could see how Government securities could be a burden to the banks when their earning assets were drying up. In fact, they needed the Government securities to make up for the reduction in revenues from other sources. Chairman Eccles, in reference to this particular criticism, once said that it reminded him of a drowning man who complained, when a life preserver was tossed to him, of such interference with his God-given right to drown.

The purchase of Government securities by banks has also been criticised by the purists who believe that banks should lend only for the immediate operation of business. There may be something in banks not holding too many Government securities, but this will probably prove the least of the banking problems that we will have to solve. At all events, the purchase of Government securities by banks has not yet resulted in inflation.

Then there is the anti-interest paying group, especially in Congress, which believes that the Government should make its own money and avoid the expense of borrowing. The chief trouble with the printing press method is that greenback issues would be reserve money and would constitute a basis for a manifold expansion of credit within the banking system. It is a false assumption that the Government can get something for nothing. It is not a choice of paying or not paying for Government expenditures. You have to pay. In borrowing, interest must be paid on the debt. These interest payments are raised through taxation in accordance with our general taxing system, which is based upon ability to pay. If the Government meets its expenditures by paper money, there is no immediate cost, to be sure, but there is also

no market test of the Government's credit and no restrictive limits as to the money it can spend. Under an inflation there would be in the end a cost to be borne by the nation as a whole and this cost would be inequitably distributed. It would be borne on a basis inverse to ability to pay because a rise in the cost of living resulting from inflation falls heaviest on the poor. It is better that the cost of financing the Government be borne through the tax system by those who can do so, rather than that the burden fall on the poorer classes through a rise in the cost of living. Banks perform a useful function in the community; capital invested in them should be permitted to earn a reasonable return. It is much cheaper, nationally speaking, for the country to support a banking system than to do without it.

HOW CAN THE SYSTEM FUNCTION?

To continue to function within the existing economic framework, banks must find earnings and they can do this only by departing from traditional forms. Instead of liquidity, banks must look for soundness of assets and in this search they must render sufficient service to their communities, so that the communities do not feel that they can dispense with the banks. Within this system, the Federal Reserve has the function of (1) regulating the cost and volume of money, although its powers in this respect are inadequate and must be strengthened, and (2) being prepared to liquefy bank assets in case of need, so that the banks may render the services needed by the public and at the same time be protected from adverse consequences of national developments beyond their control. The newly revised Regulation A, recently issued by the Board, marks a recognition of this second function. The Government itself must act as a compensatory agency to support national income when it threatens to contract and to keep up an adequate volume of deposits to carry on the community's business.

What becomes of "laissez-faire" under such a set-up? "Laissez-faire" in fact was never a reality but only a philosophy. It was perhaps nearer to being in operation in the first 14 years of this century than at any other time. Under the impact of war, inflation, and nationalism it has vanished. It has proved not to be a feasible system. Our new philosophy is not "laissez-faire," not freedom to do as we please at any cost; rather it is "laissez-vivre," freedom to live and to function in the interests both of the individual and of society. "Laissez-vivre!" is an accurate slogan, for the lives of millions of people literally depend on the proper functioning of our financial mechanism.

TRENDS OF PRINCIPAL EARNING ASSETS AND THEIR SIGNIFICANCE*

BY WILLIAM J. CARSON
University of Pennsylvania

IT IS NEARLY a quarter of a century since the establishment of the Federal Reserve system. In that span of time pronounced changes have occurred in the operations and portfolios of American banks. It is the purpose of this article to review the changes in the loans and investments of member banks of the Federal Reserve system over the entire period from 1914 to 1937 and, secondly, to indicate some of the problems that arise from the changes that have taken place.

I

Examination of the course of loans and investments over the period 1914 to 1937 as a whole reveals five shorter periods that were characterized by distinctive banking developments:

- (1) 1914 to 1920
- (2) 1920 to 1922
- (3) 1922 to 1929
- (4) 1929 to 1933
- (5) 1933 to 1937

The period, 1914 to 1920, as is well known, was dominated by an expansion of bank credit incident to financing the great War. War financing, however, left a definite imprint on bank portfolios. Along with the increase of approximately 100 per cent in total loans and investments of commercial banks in the six year period, the proportion of loans to total loans and investments, as is indicated in Chart I, declined from 76 per cent in 1914 to 69 per cent in 1919. In addition, a large part of the increase in loans that occurred during the period was due to lending on collateral by banks to investors to finance the purchase of securities. As a result of the increased holdings of government securities and increased collateral loans to finance the purchase of securities by investors the decline in the proportion of "commercial" loans in bank portfolios was greater in this period than is reflected in the statistics of total loans and investments given in the chart.

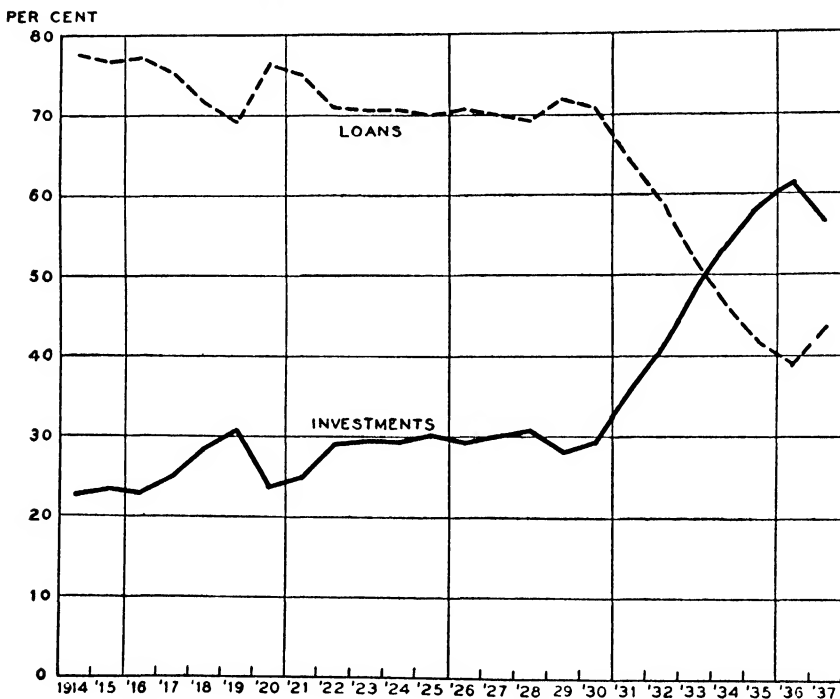
The second period, 1920 to 1922, was the period of post war liquidation. Loans and investments declined slightly from the war-time peaks but the decline was of short duration and by mid-1922 expansion was again under way.

* Condensed from a paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, December 28, 1937.

For the third period, 1922-1929, and for the subsequent periods more detailed information showing the trend of loans by types is available. Types of loans covered by the statistics are (1) loans on securities, (2) loans on real estate and (3) loans of all other types or so-called "commercial" loans. Statistics showing loans classified this way indicate in some detail the types of activity financed by bank loans and the uses to which bank funds are put.

CHART I

PERCENTAGE OF LOANS AND INVESTMENT TO TOTAL LOANS AND INVESTMENTS,
ALL MEMBER BANKS, 1914-1937



Source *Annual Reports of the Board of Governors of the Federal Reserve System.*

Examination of these data, presented in Chart II, shows that the period from 1922 to 1929 was characterized by an increase in the use of bank funds to finance "capital" as distinguished from "commercial" requirements. The proportion of loans on securities, real estate and the holdings of investments combined increased from 52 per cent of total loans and investment in 1922 to 64 per cent in 1929. The proportion of commercial loans declined during the same period from 48 per cent to 36 per cent of total loans and investments. Loans on securities alone

increased from 18 per cent of the total in 1922 to 28 per cent in 1929 while holdings of investments constituted from 29 to 30 per cent of total loans and investments throughout the period.

During the post-war period of the 1920's the trend toward the diversion of bank funds into "capital" as distinguished from "commercial" uses that had been greatly stimulated by war financing continued. An important difference, however, distinguished the post-war years from the period of the war. In the war period bank funds were directed into non-commercial uses as a result of Treasury financing; in the post-war period the forces influencing the diversion were incident to the financing of business enterprise, and of governments, local and foreign, through the securities markets.

In 1929 the rapid expansion of bank credit which had continued for fifteen years following 1914, except for the slight interruption in 1921 and 1922, came to an end. The third period, 1929 to 1933, was one of general credit contraction and liquidation. Total loans and investments declined from \$36,000,000,000 in 1929 to \$25,000,000,000 in 1933. The decline in loans amounted to nearly \$13,000,000,000 while investments increased approximately \$2,000,000,000. The decline in loans on securities and in loans of all other types was larger relative to the reduction in total loans and investments, and in 1933 these constituted only 19 and 23 per cent respectively of total loans and investments as compared with 28 and 36 per cent respectively in 1929. The decline in loans on real estate between 1929 and 1933 was relatively much less than the decline in total loans and investments. Holdings of investments increased during the period and in 1933 they accounted for nearly one half of total loans and investments as compared with slightly less than one third of the total in 1929. The increase in investments during this period was due largely to a growth in the holdings of obligations of the United States Government.

In the final period, 1933 to 1937, the contraction and liquidation which began in 1929 came to an end and a rapid expansion in loans and investments followed. Loans and investments increased from \$25,000,000,000 in 1933 to \$33,000,000,000 in 1937. Expansion from 1933 to 1936 was due almost entirely to a growth in the holdings of United States Government obligations which increased from \$12,000,000,000 in 1933 to nearly \$20,000,000,000 in 1936. In 1936 the prolonged rise in bank holdings of United States Government obligations terminated and a sharp increase in loans, particularly in loans for commercial and industrial purposes developed. Between mid-1936 and mid-1937 holdings of United States Government obligations declined approximately

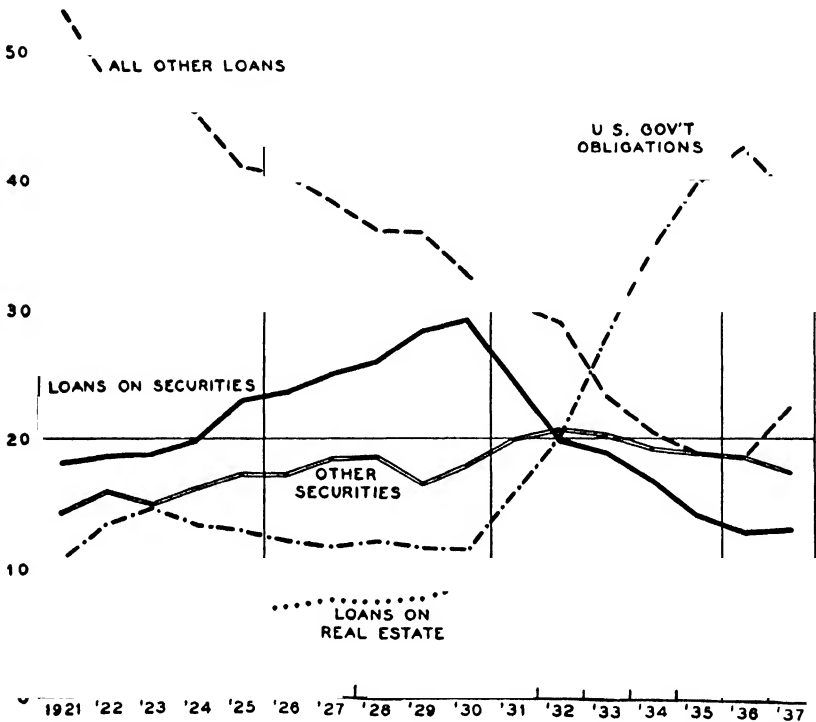
\$1,000,000,000 while loans for commercial and industrial purposes increased nearly \$1,500,000,000.

As a result of this reversal which began in 1936 and continued in 1937, the proportion of loans increased from 39 to 44 per cent and the proportion of investments declined from 61 to 56 per cent of total loans

CHART II

PERCENTAGE OF LOANS AND INVESTMENTS TO TOTAL LOANS AND INVESTMENTS,
ALL MEMBER BANKS, 1921-1937

PER CENT
60



Source. Figures showing amounts for 1921-1929 given in part in testimony of A. C. Miller of Federal Reserve Board and published in *Hearings on the Operation of the Banking System*, Part I, p 138, for 1929-1937 figures taken from *Annual Reports of the Board of Governors of the Federal Reserve System* and the *Federal Reserve Bulletin*.

and investments. Nearly all of the increase in loans was in loans to customers for commercial and industrial purposes.

Summarizing the developments in the five periods of the quarter century from 1913 to 1937, the following observations may be made:

1. Three of the five periods were characterized by rapid expansion in earning assets and two by contractions.

2. Expansion from 1914 to 1920 was due largely to borrowing to finance the war. It was mainly in the form of loans on collateral, especially Government obligations but there was some increase in the holdings of United States Government obligations and investments.

3. Expansion from 1922 to 1929 was due to a growth in loans on securities to finance the raising of funds by business enterprise or by local or foreign governmental units through the securities markets.

4. Expansion in the first part of the fourth period, 1933 to 1936, was due to deficit financing by the Federal Government and was in the form of security purchases by banks; in the second part of the period, 1936 to 1937, expansion was due to increased demands by customers to finance commercial and industrial activity.

5. Contraction from 1929 to 1933 was incident to the great depression and was relatively larger in loans on securities and in commercial loans than in other earning assets.

When the changes over the period as a whole are reviewed and the composition of the earning asset portfolios of commercial banks in 1937 is compared with that in 1914 and in 1922, the outstanding changes may be summarized as follows:

1. Between 1914 and 1937 loans declined from 78 per cent to 44 of total loans and investments, and holdings of investments increased from 23 per cent to 56 per cent of the total.

2. Between 1922 and 1937 the important changes in the composition of earning asset portfolios were a shrinkage in the proportion of commercial and industrial loans from 48 per cent to 23 per cent of total loans and investments and an increase in the proportion of the holdings of United States Government obligations from 11 to 39 per cent of the total.

3. Between 1921 and 1929, the proportion of security loans increased sharply but in the years following 1929 these loans declined substantially and in 1937 they were less in proportion to total loans and investments than in 1921.

II

As a result of the changes thus described, fundamental alterations have occurred in the portfolios of American banks over the past quarter of a century. The changes resulted from a variety of forces and their significance is reflected in many ways.

From the standpoint of banking theory, one of the reasons why the changes are significant is because they show that banks today find their role predominantly one of supplying funds to enterprise indirectly rather than directly. During the period of the 1920's this was done to an increasing extent through loans on securities and by the purchase of securities and since 1930 it has been done through the purchase of United States Government obligations. As a consequence the opinion is advanced by some that the liquidity of the portfolios of commercial banks as it was thought to prevail a quarter of a century ago when the Federal Reserve Act was written has been greatly impaired and that the ability of banks of deposit to perform their monetary functions in periods of stress has been greatly weakened. Moreover the extent to which banks are in a position to supervise the uses to which funds are put by enterprise is materially lessened when financing is indirect rather than direct.

To the individual banks, important problems arise in managing portfolios composed largely of investment securities. Testing the soundness and desirability of securities and managing a portfolio of investments is a different problem from that of handling a portfolio of loans to customers to finance commercial, agricultural and industrial transactions. And many banks, particularly the smaller ones, cannot adequately equip themselves for the job.

Another serious problem that is presented to bank management because of increased holdings of securities is that of maintaining earnings. In 1929 total earnings from current operations of all member banks were \$2,400,000,000, of which amount \$1,500,000,000 were earnings from loans, \$473,000,000 were from investments and \$363,000,000 were from all other sources. By 1936 total earnings had declined approximately 50 per cent to \$1,271,000,000 almost all of which was due to a decline of 66 per cent in earnings from loans to a total of \$513,000,000. Earnings from investments in 1936 were about the same as in 1929. Total holdings of investments, on the other hand, were 83 per cent larger in 1936 than in 1929 but the larger holdings did not result in a similar growth in earnings.

EARNINGS OF MEMBER BANKS, 1929 TO 1936
(In millions of dollars)

Year	Earnings			
	Total	On loans	On investments	All other
1929	2,399	1,563	473	363
1930	2,158	1,349	472	337
1931	1,841	1,073	480	288
1932	1,554	851	458	245
1933	1,237	604	426	207
1934	1,244	540	474	230
1935	1,207	498	467	242
1936	1,271	513	487	271

The significance of the changes in earning assets was recognized temporarily by Congress in 1932 in the Glass-Steagall Act and permanently in the Banking Act of 1935 when the Federal Reserve Act was amended by the addition of a provision "authorizing a Federal Reserve bank to make advances to its member banks on any security satisfactory to the Reserve bank at a rate of interest at least one-half of 1 per cent per annum higher than the highest discount rate in effect at such Reserve bank." Commenting upon the significance of this change in the Federal Reserve Act the Board of Governors recently said,

the broadened provision for borrowing at the Reserve banks is . . . a recognition of the fact that the scope of operations of member banks has changed. Since the passage of the Federal Reserve Act paper that qualified under the eligibility requirements of that act has constituted a decreasing proportion of the loans and investments of member banks . . . Changes in business practices, which have resulted in a decline in the extent of commercial and industrial borrowing from banks, have been partly responsible for this development. Another major factor has been the increase in the amount of savings deposited in member banks. With member banks holding \$10,000,000,000 of savings and other time deposits, as compared with about \$1,000,000,000 in 1914 they are in a position where both in their own interest and in that of the country they must make considerably larger volume of long-time investments. Such investment is an essential part of the economic process of capital formation. It seems reasonable, therefore, that these assets be given a status which will permit member banks to borrow on them from the Reserve banks when the need arises.¹

The dangers to the development and maintenance of sound banking practices that may arise from the purchase and sale of securities by banks are likewise recognized as significant by the supervisory authorities. In its annual report for 1936 the Federal Deposit Insurance Corporation comments on current practices of banks with regard to the purchase and sale of securities as follows:²

The Corporation has been viewing with concern the prevalence of speculative practices by banks in handling their investments. Over the past two or three years many banks to an increasing extent have been buying securities with a view to obtaining profits from a rise in the price of those securities, rather than with a view to obtaining reasonable earnings over a period of time. When a bank buys

¹ *Federal Reserve Bulletin*, September, 1935, pp. 560-561.

² *Annual Report of the Federal Deposit Insurance Corporation*, 1936, p. 19.

securities with the primary intention of selling them again at higher prices that bank is speculating. Dealing in high grade securities does not alter the essential speculative nature of the transaction. . . .

Over the past few years some banks have been using profits secured from speculation in securities to pay dividends and to retire preferred stock without making adequate provision for possible future depreciation in the securities purchased by them at high levels of prices. So long as banks speculate in securities they can expect at some time to incur losses. The Corporation insists that insured banks should make provision for any depreciation or losses that may occur. To fail to make such provision is to engage in an unsound banking practice. . . .

Finally, the changes in earning assets are significant to the central banking and monetary authorities because of the problems which they present to these authorities in formulating and executing monetary policies. Under present day conditions, when member banks adjust their reserve position to a considerable extent through their investment portfolios rather than by borrowing at the reserve banks, greater consideration has to be given to the possible effect of monetary policies on the holdings of securities by member banks than was the case in earlier periods. At times the investment position of banks may prove advantageous to the monetary authorities in timing and executing policies but under certain circumstances it may be definitely embarrassing. The developments that have taken place present a situation that is relatively new in banking history and of increasing practical importance.

THE ECONOMIC DISTRIBUTION OF DEMAND DEPOSITS*

BY LAUCHLIN CURRIE, *Assistant Director*
Division of Research and Statistics
Board of Governors of the Federal Reserve System

DEMAND deposits could be distributed according to size, banks, geographical regions, or by types of depositors. The present paper is concerned with the last mentioned type of distribution. The distribution of deposits by type of holder is a new field on which data have only recently become available, and the results which I shall present shortly must be regarded as tentative. They do, however, for the first time permit us to ascertain the approximate distribution by broad economic categories of the bulk of the money supply of the country.

Information of this character, could it be made detailed, accurate, and frequent, would, I believe, permit an advance in monetary and business cycle analysis. It appears indispensable if any vitality is to be imparted to the concept of velocity of money as a tool of analysis. It would give quantitative content to such concepts as "liquidity preference," "excess saving," and has some bearing on "the propensity to consume." It would give the way for a fruitful marriage between the two strands of theory centering on the one hand around the velocity of money, and, on the other, the demand for money.

Until recently it has not been possible to attempt a distribution of demand deposits by economic categories as no basis existed for an estimate of the composition of the single item of cash reported by corporations in the *Statistics of Income*. In addition, banks were included with other finance groups in the reported figures. Through the cooperation of the Treasury both these difficulties have been removed. The Bureau of Internal Revenue forms for corporation balance sheet returns, starting with December 31, 1935, contain separate headings for demand deposits, time deposits, and other cash. In addition, separate figures of the cash holdings of financial groups other than banks were made available.

In the early part of 1936 the Federal Reserve banks, at the request of the Board of Governors, sent questionnaires to the large banks, asking for information relative to their large deposit accounts on October 25, 1933 and November 1, 1935, classified by economic types. It was discovered that the percentage composition as between demand and time deposits obtained from this questionnaire for 1935 agreed

* Revision of a paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 28, 1937.

very well with the percentage composition obtained from the Bureau of Internal Revenue's special compilation for the same economic groups of those corporations that reported a breakdown of their cash item. This strengthened the presumption that the questionnaire sample was representative and the percentage composition of demand and time deposits was therefore applied to the cash item of corporations by industrial groups in the 1933 *Statistics of Income*. Estimates were made of non-corporate demand deposits and figures for other categories were obtained directly from banking reports.

The various steps in building up these distributions were carried out mainly by Martin Krost and a detailed description written by him is available on request. In general the figures for corporations and public bodies are the most reliable, while there may be a considerable margin of error in the estimates for non-corporate holdings. The increase in business balances is probably understated on two counts. In the first place, the abolition of the privilege of filing consolidated returns in 1934 probably means that certain holding companies were listed under business categories in 1933 and under finance in 1935. This would also have the effect of overstating the increase in financial deposits. In the second place, a substantial part of the item "Checks in process of collection between depositors" which represent checks deducted by payers from their reported balances, and not yet credited by payees to their balances, should be credited to business balances. This item increased over one billion dollars between the two dates. Consequently the proportion of the total represented by business balances may actually have changed between these two dates much less than is shown in the table on the next page.

Broadly speaking, it appears that at the end of 1935 business held about a third of the deposit balances in all checking accounts; finance, including foreign individuals, firms and banks and large personal accounts, nearly a fourth; public bodies a fifth. The unclassified residue amounts to slightly more than a fifth but consumers' balances proper are probably not more than a sixth. If currency outside banks were added to checking accounts, the proportions would doubtless be raised for consumers and lowered for other groups. Present data appear too fragmentary, however, to permit a reliable distribution of currency.

Perhaps the best way to illustrate the possible ways in which information on the changes in cash holdings may aid in interpreting business developments will be to consider the significance of the actual changes shown between 1933 and 1935. This period is unique in several respects. In the first place, the very large expansion in demand

deposits was mainly attributable to the Government's borrowing and spending program. Member banks alone increased their holdings of direct and guaranteed Government issues by \$5 billion. The next most important single factor in increasing demand deposits was the addition to our gold stocks apart from the gold increment. Secondly, in this period business raised virtually no new money from banks or the capital markets and the problem of tracing the sources of the increase in business deposits is thereby simplified.

ECONOMIC DISTRIBUTION OF DEMAND DEPOSITS
(Amounts in millions of dollars)

	Deposit balances		Per cent to total		Percentage increase
	Dec 31 1933	Dec 31 1935	Dec 31 1933	Dec 31 1935	
Total demand deposits	17,470	26,600	—	—	+ 52 3
Less items in transit					
In process of collection by banks	1,200	2,370	—	—	+ 97 5
In transit between depositories	1,200	2,370	—	—	+ 97 5
Total demand deposits, adjusted for transit items	15,070	21,860	100 0	100 0	+ 45 1
Business	6,120	7,640	40 6	34 9	+ 24 8
Corporations engaged in					
Manufacturing, mining, construction	2,800	3,450	18 6	15 8	+ 23 2
Transportation, public utilities	980	1,080	6 5	4 9	+ 10 2
Trade, service	1,070	1,420	7 1	6 5	+ 32 7
Miscellaneous*	50	80	0 3	0 4	+ 60 0
Non-corporate enterprises†	1,220	1,610	8 1	7 3	+ 32 0
Finance	2,670	5,390	17 7	24 7	+101 9
Corporations					
Insurance	560	920	3 7	4 2	+ 64 3
Other finance	820	1,740	5 4	8 0	+112 2
Non-corporate					
Security brokers	200	200	1 3	0 9	—
Banks' trust departments	440	1,060	2 9	4 9	+140 9
Foreign banks	130	440	0 9	2 0	+238 5
Other foreigners‡	240	600	1 6	2 7	+150 0
Large personal accounts‡	280	430	1 9	2 0	+ 53 6
Public bodies	2,690	4,130	17 9	18 9	+ 53 5
U S Treasury	1,020	1,460	6 8	6 7	+ 43 1
Other public bodies	1,670	2,670	11 1	12 2	+ 59 9
Unclassified—consumer balances, etc	3,590	4,700	23 8	21 5	+ 30 9

* Includes agricultural corporations and corporations not reporting nature of business.

† Excludes professional service, agriculture, finance, transportation and public utilities

‡ Includes foreign bank deposits with nonmember banks

‡ Accounts with balances of \$100,000 and over reported by the 98 largest member banks.

1. *Consumer or income balances.* The unclassified demand deposits do not correspond with income balances since they include personal balances up to \$100,000, many of which might more properly be included in finance. They also include balances of non-profit institutions and other miscellaneous categories. In view, on the one hand, of the substantial increase in the large personal accounts classified under finance and, on the other, of the absence of any increase in currency outside banks, the bulk of which is probably held by consumers, it

seems unlikely that small personal balances accounted for a very large proportion of the increase of \$1 billion in unclassified demand deposits. Whatever restrictive influence arose from the addition to demand deposits out of current income on the part of consumers, therefore, must have been of a fairly minor order.

The increase in the total unclassified category may very possibly reflect in large part the sales of securities, as banks, insurance companies, and foreigners added considerably to their holdings of non-Government securities in this period despite the absence of any net increase in outstanding obligations of business and local bodies. The increase in deposits arising from net sales to these categories would not at that time have been restrictive.

Although consumers apparently did not retain in the form of demand deposits any considerable proportion of the increase in their incomes, they did increase their savings deposits by some \$2 billion. Ordinarily, because of the resulting lower reserve requirements, the banking system expands its earning assets and the bulk of the savings are thus passed back to the monetary stream. However, under the conditions prevailing in this period of already large excess reserves, it is doubtful if banks expanded their earning assets by any more than they would have had no growth in time deposits occurred. Consequently the growth in time deposits probably represented a restrictive development.

2. *Public balances.* The increase in the Federal Government's balances did not arise from the excess of current receipts over expenditures but rather from borrowings. Since there is no reason to believe that these increased deposits would have been expended if the Government had not borrowed them, the increase should not be regarded as restrictive. The increase in the balances of other public bodies, however, may have in part represented a diversion of tax receipts into sinking funds and other accounts. The indebtedness of public bodies other than the Federal Government remained virtually unchanged in this period.

3. *Foreign balances.* The increase of \$600 million was probably associated with the inflow of gold and hence was not restrictive.

4. *Financial deposits.* Although, as previously indicated, the increase in financial deposits may be overstated owing to the change in classifications arising from the abolition of consolidated returns in 1934, still the increase was substantial. It does not appear that it can be attributed to a net sale of securities or by redemptions. Life insurance company holdings of the securities of non-public bodies increased by over \$500 million in this period. There is some indication that business

redeemed more bonds than it issued, although not to an amount comparable with the indicated increase in financial deposits. It is possible that a part of the increase in financial deposits may be attributed to the refinancing of mortgages by Government agencies but the bulk of such refinancing took the form of exchanges of Government guaranteed bonds rather than cash for mortgages. Even allowing for these and other types of debt redemptions it would still appear that a substantial portion of the increase in financial deposits must be attributed to some individuals' failure to spend all of their large salaries, the failure of insurance companies to invest all of their current receipts, and the failure of individuals and institutions to spend or invest all of their interest and dividends. In other words, the increase in these balances represented in part a withdrawal of funds from the monetary income-disbursement stream and was a restrictive factor.

5 *Business balances.* In accounting for the increase in business balances we may proceed by a process of elimination:

(a) It was not attributable to increased borrowings from banks or from other sources. The net long-term indebtedness of all business units probably declined in this period. A comparison of the funded debt of 530 industrial corporations on December 31, 1933, and December 31, 1935, indicated a decline of \$251,000,000. The holdings of marketable securities of the same corporations, however, also declined by \$356,000,000. The cash holdings of this particular group of corporations increased from \$1.6 billion to \$2 billion.

(b) It is highly doubtful if the repatriation of capital on the part of American business could have occurred in an amount sufficient to account for more than a small part of the increase in business deposits. It is believed that the great bulk of the inflow of capital was for the account of foreigners.

(c) Finally, in view of the recovery movement and the extension of time and installment sales, it appears improbable that any excess of cash could have come about through a decline in the net indebtedness of individuals to corporations.

We arrive, therefore, at the conclusion that the major part of the indicated increase in business deposits must be attributed to the retention of receipts from sales of goods and services. It is perhaps possible to push this stage of the analysis one step further. Current receipts of business cover costs and profits, if any. Since labor and material costs, representing actual out-of-pocket expenditures, increased in this period, it would appear that the increase in business deposits is either a reflection of a failure to disburse money to the full amount represented by such costs as depreciation, bad debts, and loss on sale

of capital assets, or to the full amount represented by profits, or both.

We may now seek to relate the above discussion of the sources of increases in different classifications of balances to a broad interpretation of business developments in the period under discussion.

The Federal Government disbursed funds which came in part from consumer, business and financial deposits, and in part from deposits newly created by the banking system. These disbursements were partly for refinancing purposes but mainly for purposes which directly increased the buying power of individuals. A previous unpublished study by Mr. Martin Krost and the present writer indicated that the net activity-increasing expenditures of the Federal Government amounted to over \$6 billion in this period. This figure was obtained by adding together those expenditures of the Government which appeared to increase spending and business activity directly and subtracting tax receipts (except estate and gift taxes) which might be held to decrease spending and business activity. The actual net activity-stimulating figure is doubtless higher, since it is unlikely that the collection of corporate and personal income taxes in this period decreased private spending correspondingly.

Those funds disbursed by public bodies which went directly into people's incomes were probably used in large part to purchase goods and services, in part used to liquidate past indebtedness and in part "saved." Of the part saved, in turn, a portion was probably added to demand deposit balances, a portion to time deposits, and a portion went into financial deposits via insurance companies and purchases of stocks and bonds. A part of the resulting increase in financial deposits was again borrowed by the Government and respent.

The larger portion of Government disbursements to individuals which was spent directly for goods and services was in part disbursed in turn by business in the production of more goods and services, in part used by business to liquidate indebtedness, and in part was added to business balances. The same was doubtless true in the case of direct disbursements of public bodies for supplies and materials. Thus, business was able to add to its balances, refrain from borrowing, and at the same time increase its production and its disbursements to the factors of production. A portion of business disbursements was retained by consumers, finance and possibly non-Federal public bodies.

The increased disbursements of business increased incomes and the demand for goods, but the increased disbursements were in response to previous increases in demand. The process may be viewed as (a)

an increased demand for the products of industry arising from the incomes earned by the factors of production, plus the incomes derived from Government spending, and (b) a further increase in demand resulting from the increased disbursements of business in response to the initial increase in demand. The wave-like movements of business were doubtless due largely to inventory changes, but we are here concerned with the broad upward movement. The continuation of activity-stimulating expenditures of the Government was necessary because the initial impetus of Government spending quickly lost its momentum in the conditions prevailing in this period. A portion of the receipts of both business and consumers remained unspent.

This interpretation of business developments is consistent with (a) the indicated increase in consumer, business and financial deposits, (b) the increase in the national income and production, and (c) the failure of business to borrow and spend the current savings of the community. The increase in deposits of all groups was made possible in very large part by the borrowing and spending by the Government of newly created deposits. Business was able to increase both its disbursements and its balances because a substantial portion of the income devoted to the purchase of the products and services of business was not derived from the disbursements of business but from those of the Government. The failure of business to borrow the current savings of the community did not lead to a decline in incomes, since the current savings were in large part borrowed by the Government and passed back by it into the income stream. The collection and spending of corporate and personal income taxes and estate taxes by the Government resulted in a reduction of idle balances in the hands of taxpayers rather than a reduction of taxpayers' expenditures.

Unless we account for the excess of business sales over disbursements in terms of the increase in incomes due to Government spending, we will be forced to the view that consumers not only spent all their incomes derived from business on the products of business, but, in addition, drew down their balances and/or borrowed, and/or sold securities to institutions or savers—in short, that the savings of consumers were a negative quantity. In view of (a) the direct evidence that Government spending increased some persons' incomes and (b) the indirect evidence of saving on the part of consumers, we are forced to reject the hypothesis that increased business disbursements constituted the motivating force in the recovery movement. The assumption that throughout all this period the fiscal policies of the Government were causing the income of the community to be in excess of the disbursements of business to the factors of production plus the

payment of taxes, appears to be necessary to explain the concomitant increase in consumption and unexpended savings.

There were, of course, other factors in the situation. We are here, however, concerned with the broad picture and it is difficult to reconcile the various observable facts without placing heavy emphasis on the part played by the Federal Government in bringing about an increase in incomes and expenditures in the period under discussion.

My main purpose in the preceding discussion has been not so much to interpret a particular period as to illustrate how information of the character under discussion might be useful. If space permitted, other illustrations might be offered bearing upon the adequacy of a given volume of money to support an anticipated level of activity, upon the course of interest rates, upon the shifts in balances as between different economic groups that may be expected to occur in different phases of the business cycle, and the implications and repercussions of such shifts. For instance, if it is found that the balances of public bodies and finance are abnormally high in the depression phase of the cycle it may be anticipated that they will be gradually drawn down to more normal levels and shifted into industrial and personal holdings as recovery proceeds. Thus, the increasing monetary requirements of business and consumers incident to an expansion of production and incomes may be met without necessarily entailing a rise in interest rates or the creation of new money. Similarly, a shift into financial deposits in the peak or early recession phases of the cycle may be a very deflationary development taking place under cover of an unchanging volume of money. This brings us back to the remarks at the beginning of this paper to the effect that data on the distribution of money would permit a significant advance in the understanding of the factors reflected in changes in income velocity.

TRENDS OF BANK EARNINGS AND EXPENSES*

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THE present paper deals with the following points: (1) determination of factors affecting the trend of bank earnings; (2) measurement of the profitability of banking operations; (3) influence of size upon the profitability of banking operations; and (4) problems relating to the study of losses on assets.

Determination of factors affecting the trend of bank earnings. There are a number of factors which are believed to affect bank earnings. Among them may be mentioned size of bank; geographic location; size of community; income of community; economic characteristics of area served; competitive situation, whatever that may mean; type of business, as measured by distribution of assets and liabilities and relative importance of different sources of earnings; risk involved in type of business done; capital ratios; type of bank, that is, whether independent unit bank, branch bank, or member of a group or chain; and class of bank, that is, national, State bank member of the Federal Reserve System, commercial bank not a member of the Federal Reserve System, and savings banks.

Our intensive work has been confined chiefly to data for the years since 1934 collected from 7,500 insured commercial banks not members of the Federal Reserve System. After preliminary study of the data for 1934 and 1935 the conclusion was reached that if worth while results were to be obtained, ratios would have to be computed for each individual bank and the distribution of the individual ratios analyzed. Consequently, for 1936, about 40 balance sheet and earnings ratios were computed for each bank, punched cards were made up and frequency distributions obtained by mechanical sorting.

There are important limitations upon the data and, consequently, upon the results which may be obtained from them:

(a) The nature of bank accounting records and practical limitations upon the type of data which may be collected from those records seriously limit the applicability of the material to numerous problems;

(b) The data relate only to a short period of time, for the most part one year. This shortcoming will be remedied as fruitful parts of the investigations are carried forward;

(c) The data relate only to one class of bank, insured banks not

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members of the Federal Reserve System. This class of bank constitutes more than one-half by number, but holds only about one-seventh of the assets, of all of the so-called commercial banks. The sample is biased, therefore, as to size of bank and possibly as to other characteristics.

The results of our study, therefore, may have corresponding biases. Whether or not we shall attempt to analyse the data for national banks and for State banks members of the Federal Reserve System, I do not know. It is a big job. I earnestly hope that whoever may undertake the analysis of these data will do a sufficiently comprehensive job to test thoroughly conclusions which may be reached. In my opinion, results which may be obtained in this field by short-cut methods are more apt to be misleading than revealing.

Measurement of the profitability of banking operations. It appears to be relatively easy to measure for any period of time the profitability of the operations of any group of banks for which the data may be available. But to measure profitability to any purpose and to obtain results from which valid generalizations may be made is extremely difficult.

Banks report their earnings, expenses, and net earnings (or deficits) from current operations. These data are supposed to reflect only income and expenses arising out of those types of operations which normally recur from year to year. In addition, banks report in separate categories unusual income in the form of profits from the sale of assets and in the form of recoveries on assets previously written down on the books or charged off. They also report in separate categories losses actually sustained or expected to be sustained on assets and any unusual amounts of depreciation.¹

Net profits are determined by adding to net current operating earnings all recoveries and profits on assets and deducting all losses on assets. Net profits, therefore, reflect to a considerable extent irregular and nonrecurring items, which, for any year or group of years, may include unusual factors. Before general conclusions can be drawn from such data regarding the profits of banks we must be sure that the periods covered are representative and that the unusual factors average out to a fairly typical experience. Except for use in a few very simple analyses the data available for the study of net profits do not appear adequate to permit of useful generalizations. Most of the studies which have been made to date must be accepted with so many reservations as to make them of doubtful value.

¹ In reporting to their respective agencies national banks and State banks members of the Federal Reserve System report all depreciation under the separate heading of losses and do not treat ordinary and regularly recurring depreciation as an expense.

In measuring profitability of banking operations the most useful procedure is to analyze separately the recurring and nonrecurring items, establish general conclusions regarding the recurring items, do what one can with the nonrecurring items and attempt to fit the nonrecurring items into the picture with a series of assumptions. The figures relating to regularly recurring items of earnings and expenses and to net current operating earnings seem to follow fairly consistent patterns and consequently yield readily to statistical analysis. The data of recoveries and profits on assets and of losses and unusual depreciation are too erratic and the pertinent factors too involved to yield easily to analysis, given the data and techniques that we have.

Size as a factor in earnings. Size has been considered an important factor in determining the profitability of bank operations. Analysis made thus far of available data, however, does not appear to me to support the thesis that there is a definite correlation between size of bank and profitability. Table I shows for 1934, 1935, and 1936 net current operating earnings per \$100 of total assets of insured commercial banks not members of the Federal Reserve System, grouped according to size, as measured by their deposits. In 1935 and 1936 the rate of net earnings on total assets declined as the size of the bank increased.²

TABLE I
NET CURRENT OPERATING EARNINGS PER \$100 OF TOTAL ASSETS, INSURED
COMMERCIAL BANKS NOT MEMBERS OF THE FEDERAL RESERVE SYSTEM,
CALENDAR YEARS 1934, 1935, AND 1936

	Number of banks			Net current operating earnings*		
	1934	1935	1936	1934	1935	1936
<i>All banks</i>	7,379	7,508	7,460	\$0 87	\$1 07	\$1 18
<i>Banks with deposits of—†</i>						
\$ 100,000 or less	1,186	898	741	73	1 25	1 39
\$ 100,000 to \$ 250,000	2,492	2,406	2,327	85	1 23	1 36
\$ 250,000 to \$ 500,000	1,720	1,909	1,998	85	1 21	1 29
\$ 500,000 to \$ 1,000,000	1,021	1,193	1,238	.87	1 15	1 26
\$ 1,000,000 to \$ 2,000,000	585	660	701	87	1 08	1 15
\$ 2,000,000 to \$ 5,000,000	255	314	332	.93	1 06	1 13
\$ 5,000,000 to \$10,000,000	116	124	{76}	91	1 00	{1 24
\$10,000,000 to \$50,000,000			{43}			{1 11
More than \$50,000,000	4	4	4	\$	\$	\$

* Amounts per \$100 of total available funds for 1934 and of total assets for 1935 and 1936. For 1934 and 1935 condition figures are as of December 31, for 1936 they are averages of end-of-month figures.

† For 1934 and 1935 deposits are as of December 31, for 1936 deposits are averages of end-of-month figures.

§ Figures are not representative and have therefore been omitted.

Note. Data are for banks operating throughout the entire year.

The same tendency is shown by figures for 1935 of banks members of the Federal Reserve System. The figures are presented in Table II.

² For 1934 the relationship was the reverse. The difference in trend may be due to errors in the figures which are believed to be substantial for that year.

TABLE II
NET CURRENT OPERATING EARNINGS PER \$100 OF TOTAL ASSETS OF
INSURED COMMERCIAL BANKS, CALENDAR YEAR 1935*

	Number of banks	Net current operating earnings			
		All banks	Members F R System		Not mem- bers F R System
			National	State	
<i>All banks</i>	13,847	\$0 88	\$0 88	\$0 82	\$1 07
<i>Banks with deposits of—†</i>					
\$ 100,000 or less	965	1 27	1 45	1 43	1 25
\$ 100,000 to \$ 250,000	3,045	1 22	1 19	1 16	1 23
\$ 250,000 to \$ 500,000	3,242	1 19	1 17	1 08	1 21
\$ 500,000 to \$ 1,000,000	2,720	1 12	1 10	1 13	1 15
\$ 1,000,000 to \$ 2,000,000	1,799	1 08	1 08	1 06	1 08
\$ 2,000,000 to \$ 5,000,000	1,240	1 04	1 02	1 10	1 06
\$ 5,000,000 to \$50,000,000	727	90	88	90	1 00
More than \$50,000,000	109	79	80	78	‡

* Amounts per \$100 of total deposits plus total capital account in the case of national banks and State banks members of the Federal Reserve System and of total assets in the case of banks not members of the Federal Reserve System.

† Deposits are as of December 31, 1935

‡ Figures are not representative and have therefore been omitted

Note. Data are for banks operating throughout the entire year

For the years 1926–30, inclusive, the Federal Reserve Committee on Branch, Group, and Chain Banking compiled data of earnings of national banks grouped according to size as measured by loans and investments. Table III shows data derived from figures presented in the Committee report.

TABLE III
NET EARNINGS AND NET PROFITS PER \$100 OF TOTAL DEPOSITS PLUS
TOTAL CAPITAL ACCOUNT, NATIONAL BANKS, 1926-1930

	Number of banks	Net earnings	Net profits
<i>Banks with loans and investments of—</i>			
Less than \$150,000	353	\$1 32	\$0 02
\$ 150,000 to \$ 250,000	741	1 58	38
\$ 250,000 to \$ 500,000	1,619	1 68	.63
\$ 500,000 to \$ 750,000	1,053	1 80	.88
\$ 750,000 to \$ 1,000,000	725	1 77	.91
\$ 1,000,000 to \$ 2,000,000	1,330	1 74	.98
\$ 2,000,000 to \$ 5,000,000	1,019	1 74	1 04
\$ 5,000,000 to \$10,000,000	312	1 65	1 04
\$10,000,000 to \$50,000,000	211	1 60	1 06
\$50,000,000 or more	40	1 63	1 16

Figures for individual years show that in 1926 and 1927 the most profitable national banks were those with loans and investments of \$750,000 to \$1,000,000; in 1928 and 1929 the most profitable were those with loans and investments of \$500,000 to \$750,000; and in 1930 the most profitable had loans and investments of \$250,000 to \$500,000. In 1935 the most profitable group of the national banks was the group with deposits of \$100,000 or less. The most we can say about these figures is that they are not sufficiently conclusive to show any

correlation between size of bank and profitability as measured by the rate of net earnings on assets.

In contrast with net earnings, net profits presented in the last column of Table III tended to increase with an increase in size of bank. The difference is due primarily to the varying loss experiences of the banks which in turn appear to reflect the economic circumstances under which the banks operated.

The figures of small banks are dominated by figures of banks in agricultural and rural regions, particularly in the Midwest and South. The figures of large banks are dominated by figures of banks in industrial and financial centers, particularly in the North and East. During the period 1926-30 banks in the agricultural regions were still feeling the effects of post-war adjustments in agriculture. Many of the banks' loans were in default and the banks were taking substantial losses on assets which had gone sour. Industry and finance, on the other hand, were active and prosperous. The large industrial banks had recovered from the crisis of 1920 and were happily financing the new era in which losses did not exist and never were to be!

The loss experience of the larger banks was characteristic of a period of prosperity; that of the small banks appeared to be characteristic of a period of depression. It seems, certainly in retrospect, that the situation was not at all a characteristic one and was of such a nature as to result in an unfavorable showing of small banks as compared with large banks.

Some support is afforded this position by figures of country and city national banks for the decade of the twenties and for recent years. The most recent data for national banks reveal a tendency for losses on assets of both country and city national banks to approximate each other.

Size of bank and profitability of invested capital. Figures of insured banks not members of the Federal Reserve System show that there is little, if any, causal relation between size of bank and the rate of net earnings on invested capital. If there is causal relation it is so complex and so involved with other factors that it will be a long time before it is successfully measured. Data for State banks members of the Federal Reserve System also reveal no correlation between size of bank and profitability of invested capital. Figures of national banks show a tendency for the ratio of net earnings to total capital account to average lower in small banks than in large banks, the smallest banks averaging less than \$5.00 and the very large banks approximately \$8.00 per \$100 of total capital account. The Federal Reserve Committee on Branch, Group, and Chain Banking obtained somewhat similar results for national banks during the period 1926-30.

It cannot be concluded from the data for national banks, however, that there is necessarily any causal relation between size and profitability. We have ascertained that in the smaller banks generally the capital accounts are a larger proportion of total assets. The data shown in Table IV would appear to indicate that the relationship of total capital account to total assets was much more important in determining the profitability of capital as measured by net current operating earnings than was size of bank.

TABLE IV
NET CURRENT OPERATING EARNINGS PER \$100 OF TOTAL CAPITAL ACCOUNT OF
INSURED COMMERCIAL BANKS NOT MEMBERS OF THE FEDERAL
RESERVE SYSTEM, CALENDAR YEAR 1936

	All banks	Banks with ratios of total capital account to total assets of—				
		10 per cent or less	10 to 20 per cent	20 to 30 per cent	30 to 40 per cent	40 to 90 per cent
<i>All banks</i>	\$8 89	\$13 35	\$9 15	\$5 88	\$4 53	\$4 00
<i>Banks with deposits of—*</i>						
\$ 100,000 or less	6 05	12 28	8 19	5 57	4 23	3 78
\$ 100,000 to \$ 250,000	8 31	12 36	9 04	6 19	4 85	5 77
\$ 250,000 to \$ 500,000	9 81	12 93	9 60	6 25	5 40	5 48
\$ 500,000 to \$ 1,000,000	9 97	14 32	9 36	5 48	4 90	2 50
\$ 1,000,000 to \$ 2,000,000	9 31	13 90	8 65	4 75	4 17	50
\$ 2,000,000 to \$ 5,000,000	8 61	12 21	8 19	5 54	4 58	2 50
\$ 5,000,000 to \$10,000,000	9 36	12 75	9 52	5 10	5 63	—
\$10,000,000 to \$50,000,000	9 76	15 19	7 92	4 38	4 58	—
More than \$50,000,000†	—	—	—	—	—	—

* Deposits are averages of end-of-month figures

† Figures for this group are not representative

Note Data are for banks operating throughout the entire year

Losses on assets. Our data appear to be inadequate for satisfactory analysis of losses on assets. On the basis of available data for national banks it has been possible to estimate the average annual rate of loss less recoveries on assets over a long period of time. The data do not reveal the extent to which banks suffer loss on different types of assets, nor are they available in such form and for such periods as to enable us to ascertain what the normal loss experience is. It is impossible to ascertain what the net return to a bank on different types of credit risks is. We know that for national banks during the period 1918-36 the rate of loss on total securities was about the same as on total loans, or at an annual average rate of approximately 1 per cent per annum. We do not have adequate data, however, regarding the types of loans on which losses are taken and consequently the differentials in rates necessary to cover the various degrees of risk in various types of loans. This appears to be a matter of some importance in dealing with adjustments in interest rates, particularly when we realize that under the stress of competition institutions may through one device

or another cut rates to a level that will cover costs and profits but not risk.

In the case of securities it has been possible on the basis of a few assumptions to estimate within reasonable limits the difference in rates of loss between certain classes of securities of a recognized high grade and other securities. On the basis of these studies, it appears that a differential in yield of not less than $1\frac{1}{2}$ or 2 per cent was necessary in order to assure the same net yield on the two classes of securities. These figures are only tentative and, unfortunately, we cannot go beyond this point with our present data. It is not possible to ascertain, for example, the difference in loss that has actually been taken on different types and qualities of securities by banks of different characteristics, in different localities, and operating under different conditions. This does appear to me, however, to be an important subject for investigation.

The rate of loss on securities other than those issued by the United States Government appears to have averaged approximately twice the rate of loss on loans. If the change in bank assets which has been observed in recent years persists and banks continue to hold larger and larger proportions of such securities, it would seem that the quality of such securities held by the banks must be materially improved. Net current operating earnings of the banks are not at a level sufficiently high to absorb a 2 per cent loss ratio on any large proportion of assets.

These figures, crude as they are, throw some light upon supervisors' concern over the practice of banks of trading in securities and paying dividends from the profits thereon. When a bank sells some securities at a profit, but buys others of comparable quality, there has been an increase in total book value but no essential change in par values of the securities held. When this procedure is followed by payment of dividends predicated on profits from the sale of securities, cash assets are reduced and the essential strength of the bank's position is weakened. Over the long period we can expect banks as a group to take losses on securities that are at least as great as their profits on securities.

SOME PROBLEMS OF BANK SUPERVISION*

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BANK supervision has existed for a variety of purposes. When bank notes constituted a sizable portion of the circulating medium of the country, such supervision was conceived of primarily as a means of regulating the quality of the currency. It might be supposed that when bank deposits were substituted for bank notes as the chief part of the country's currency, the main purpose of bank supervision became control of this new circulating medium. Actually, however, it appears that the supervision of the last fifty years has been conceived of primarily as a device for assuring minimum safety standards for a certain class of wealth. Supervision of commercial banks has rested upon essentially the same bases as the supervision of mutual savings banks, building and loan associations, and life insurance companies. Together, these constitute a class of business institutions in connection with which the public early decided that the rule of *caveat emptor* could not properly apply. Supervision of these financial institutions has attempted to control the quality of an economic service or commodity. Thus, bank supervision has fallen into that category of government functions which involves the standardization of commodities or services.

FEDERAL DEPOSIT INSURANCE AND BANK SUPERVISION

The preoccupation of bank supervision with the interests of bank customers, particularly depositors, has been somewhat altered by the introduction of Federal insurance of bank deposits. In so far as their deposits are insured, most depositors have relatively little interest in the quality of the banks with which they deal. As of January 1, 1934, the fundamental *raison d'être* of bank supervision changed. Previously, bank supervision was a service directly to banking customers. Since that date, bank supervision has become primarily a device whereby the government protects a government corporation from undue loss. This change does not necessarily mean that the socially desirable standards of bank supervision should now be higher than they should have been in the previous situation. The need for fireproof buildings is not greater when fire insurance is in operation than when it is non-existent. But, despite the change in the basis of bank supervision in recent years, its

* Revision of a paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 28, 1937.

nature and the problems with which it has to deal have not changed fundamentally.

In the following analysis I shall assume that we are talking about a fractional reserve banking system operated for profit. I shall assume that the general business structure in which the banking system operates is in the main one of free enterprise and private profit. These assumptions may or may not conform to the existing situation. Furthermore, I mean to make no commitment as to whether these assumptions should exist in reality. It simply appears to me that they are useful assumptions for present analytical purposes.

BANK SUPERVISION AND PRIVATE ENTERPRISE

Bank supervision, as we have known it, and as I conceive of the term remaining significant, operates upon the assumption that banking is a private-profit enterprise. If banking is to remain a private-profit enterprise, the business men engaged in it must be free, within definitely prescribed limits, to exercise discretion in conducting their business and must be free to profit or suffer loss from their decisions.

While it is true that banking is possessed of a peculiar public interest, it is not in any useful sense a public utility; the laws, rules, and logic applicable to other businesses which we term public utilities are not, for the most part, applicable to banking. Neither is it evident that the peculiar public interest which inheres in banking justifies arbitrary interference in the operation of banks. It is not uncommon to note that banking has a peculiar public interest and to assume that making this statement justifies any particular arbitrary interference in the business which may be suggested. I submit that it is necessary to decide definitely what sorts of interference are demanded by this peculiar public interest which inheres in banking and to reject all proposals for interference which do not conform to the principles decided upon.

The fundamental function of bank supervision is to limit the risk of bank failure, i.e., the risk that the value of the assets of a bank may fall below the amount of its liabilities. As I see it, there are two chief avenues by which this control of risk of failure may be maintained. The first is by exercising an influence over the respective portions of a bank's funds which represent equity and which represent debt. The second is control of the quality of assets held by banks.

CONTROL OF BANK CAPITAL

Let us consider first, possible rules concerning the capital of banks. It has long been customary for bank law and bank supervisors to provide for minimum absolute capital requirements. But no very

definite or satisfactory proof has ever been forthcoming that this was a useful approach to the problem. Rather, the necessity is for rules drafted in the form of relations of equity to total banking funds. The simplest and most satisfactory statement of such rules sets up minimum relations of capital funds to total funds in a bank, or, otherwise stated, to total assets. Such a ratio shows the proportion of total funds which are supplied by owners as compared with creditors, and shows the proportion by which assets could depreciate before resulting in bank failure.

In connection with certain problems, capital has sometimes been related to specific asset categories. For example, in deciding what volume of bonds banks might reasonably hold, capital has sometimes been related to total bond account.¹ Some such analyses have assumed that adequate reserves are set up in connection with other assets and that, consequently, all capital accounts are available as a cushion against depreciation in the bond account. On the other hand, some analyses have related total capital account to total loans, assuming that adequate reserves have been set up to provide for possible depreciation in other assets.² However, neither of these inconsistent approaches seems reasonable or useful. Total equity is available as a cushion protecting creditors against depreciation in total assets, not against depreciation in assets of some particular category.

During the past 60 or 70 years, the proportion of banking funds supplied by the owners has shown an enormous decline. In 1875, about 35 per cent, and in 1890, 30 per cent of the funds of the commercial banks of the United States were supplied by owners.³ By 1920, owners were supplying only 12 per cent. Since 1920, the ratio for the banks as a whole has not changed materially.

Approximately one-third of the bank deposits of the country are now in banks having capital of less than 10 per cent of assets.⁴ Over two-thirds of the very large banks of the country have capital ratios below 10 per cent. No other business has attempted to operate with so small a portion of its funds supplied by owners. Even in the case of the railroads and the public utilities, nominal equity has always amounted to at least 40 per cent of assets.

The practice of commercial banks, of operating almost entirely with the funds of creditors and to only a very small extent with the funds of owners, has not been confined to the United States. In England, capital

¹ *Investment Bulletin*, Indiana University, November 1937; *Wall Street Journal*, July 13 and July 28, 1937; *Financial and Investment Review*, University of Minnesota, October 1937

² "If Bonds Decline" by E. Sherman Adams, *Banking*, November 1937, pp. 22-23.

³ Computed from *Annual Reports of the Comptroller of the Currency*

⁴ Estimated from *Federal Reserve Bulletin*, August 1937, p. 798.

funds of commercial banks are 6 per cent of total funds; in Germany, 8.8 per cent; in Scotland, 9 per cent; in Ireland, 9 per cent; and in France, 10 per cent.⁵

DOUBLE LIABILITY

Previous to July 1, 1937, bank creditors were protected against asset depreciation to an extent considerably greater than that indicated by the capital ratio figures by double liability. Since the middle of 1937, however, this factor had ceased to be operative with respect to the bulk of the banks. Many aspersions have been cast upon the usefulness of double liability as a factor affording safety to bank creditors. However, a study of experience indicates that on the whole, some 45 or 50 per cent of double liability assessments have been made good.⁶ This would seem to indicate that from the standpoint of protection to depositors the capital of the banks has, in effect, been considerably greater than that which nominally appeared. Furthermore, collections might have been somewhat more complete if certain administrative reforms had been inaugurated.

The chief argument in support of abandonment of double liability was evidently the belief that bank stock would be more popular and the capital ratios of the banks would be increased. But no evidence has been forthcoming that capital ratios will be raised even though double liability is removed. Since capital ratios in other countries have declined to even lower levels than those of this country, there is reason to believe that the decline in the capital ratio is due to factors other than the existence of double liability. Possibly double liability did not contribute substantially to the proper operation of the banking system; but certainly it was not entirely without net benefit. There is no indication that anything is being substituted to take its place. In a sense it may be said that the capital of the banks of the country was suddenly reduced by a large amount on July 1, 1937.

Official attention to the problem of a substitute for double liability has taken two chief forms. First, some pressure has been exerted to set a minimum capital ratio. Second, requirements have been instituted that surpluses shall be built up to a certain relation to par capital. But the surplus requirements seem to be without major significance. Their inadequacy is illustrated by the practice of increasing surplus by the simple device of reducing par capital. Any requirements of the supervisory authorities with respect to the relation of particular capital accounts to each other are of quite minor significance.

⁵ *League of Nations Money and Banking 1936-37*, Vol II.

⁶ *Annual Report of the Comptroller of the Currency for 1936*, p. 35

CAPITAL SUPERFLUITY

Bankers, students of banking, and bank supervisors have often given evidence of a vague feeling that banks must not have "too much capital." It has been alleged that if capital were too great in relation to total banking funds, operations would not be profitable. But there is no evidence to support this position and no principles have ever been devised showing how much capital is "too much." Apparently this concept is for the most part peculiar to the banking business. It is not commonly thought that other businesses will prove unprofitable if equity is too large in relation to total invested funds. It is true that many business men consider desirable the leverage which results from borrowing a large proportion of their funds. But it is generally recognized that such leverage introduces a highly speculative factor. It is peculiar that it should be thought that the greatest leverage is necessary in that business which presumably should be the most conservative of all businesses.

PROFIT RATES ON BANK CAPITAL ACCORDING TO RATIO OF CAPITAL TO ASSETS

Ratio of total capital account to total assets, per cent	Average net earnings per \$100 of total capital account*	Correction for losses†	Theoretical profit per \$100 of total capital account
1 to 10	\$13 35	\$12 50	\$0 85
10 to 20	9 15	8 33	.82
20 to 30	5 88	4 00	1 88
30 to 40	4 53	2 86	1 67
40 to 50	3 88	2.22	1 66
50 to 60	4 25	1 82	2 43

* Arithmetic mean of ratios for 1936 computed for 7,459 insured commercial banks not members of the Federal Reserve System

† This correction by an amount equal to 1 per cent of total assets is based on a study of reported losses of national banks (fiscal years 1918-36) The figure is a very tentative one and the results of correction upon a basis of it are not exact They simply give some idea of the sort of correction which needs to be made Whether or not the assumption of independence of rate of loss on assets and capital ratio is proper, we do not know

From an analytical standpoint it is difficult to see how the banking system, within any significant limits, could have too much capital. If additional capital were introduced into any given bank, an addition to gross earnings could be made by an amount equal to the earnings upon that specific increment. Thus, the additional capital could earn whatever it could have earned if invested directly in assets of comparable safety by its owners rather than through the medium of the bank. Thus, the owners of the bank as a whole will earn upon their funds about the same amount as if they had continued to have only a portion

of their funds invested in the capital of the bank and another portion invested directly outside the bank.

It is true that certain statistical analyses indicate that in practice there is some inverse correlation between the capital ratio of banks and the rate of earnings upon the capital of banks. However, this inverse correlation may be explained by two primary factors neither of which militates against high capital ratios either from the standpoint of bank supervisors or from the standpoint of investors in bank stock. In the first place it is to be expected that the rate of earnings on capital will be less in banks with the higher capital ratios because of the lower risk. When the earnings data of insured banks not members of the Federal Reserve System are adjusted for an assumed average loss of one per cent per annum on total assets, the resulting rate of profits on capital shows no negative correlation with capital ratio.

In the second place, a great many of the banks having high capital ratios presumably had planned to attract much greater amounts of deposits than they possess. Their low earnings are due not to the large capital, as such, but to the large overhead incurred in anticipation of greater volumes of business than actually resulted.

CONTROL OF QUALITY OF ASSETS

We turn now to the second great category of rules in bank supervision, namely, those which exercise an influence over the quality of assets held by banks. A few rules may apply to the assets in general. For example, the rule which provides that the total extensions of credit to any one borrowing interest shall be limited to a certain percentage of capital funds or to a certain percentage of total assets, has proved a very useful one.

The quality of the loans of banks receives a great portion of the attention of bank supervisors. Some of the rules in this connection have to do with the security behind loans. For example, it is commonly required that a mortgage loan shall not be greater than a certain maximum percentage of the appraised value of the security. Rules with respect to security loans are now designed primarily with a view to general credit control and cannot be termed rules of bank supervision. Supervisors have long engaged in general quality classification of loans. Unfortunately the logic behind such classification has been obscured by the use of the term "slow" in connection with one of the major classes.

Clarification of loan classification would be promoted if the concept of degree of risk were in the mind of the person who is doing the classifying and if the substandard loans were thought of as those involving

an undue degree of risk. Classification of loans depends, and apparently must continue to depend, upon the judgment of the examiners. They will consist both of loans which were unduly risky when made by the bank and those which have acquired unduly risky characteristics since acquisition. As a general principle, it is necessary that the banks shall dispose of loans so classified. The success of such classification depends upon a gradual growth of understanding between the supervisors and the bankers concerning proper quality standards.

Supervision of the securities held by banks has made use of somewhat more definite rules than have been possible in the case of loans. Ownership of equities has, for the most part, been prohibited. In the case of bonds, the end in view is to confine bank holdings to those having but a small risk of default. The use of the ratings of the private rating agencies in this connection is an attempt to apply uniform minimum quality standards.

PRICE FIXING IN THE BANKING FIELD

Price determination in the banking field by government officials is becoming increasingly important. Many statistical analyses of banking data are conceived of as being useful in the price fixing process. But as yet no adequate statement has appeared justifying the extension of government price fixing to the banking field. Neither has anyone worked out the principles which should guide price fixing in this field nor the necessary accompanying principles of administration. Until such statements of principles appear, the burden of proof surely rests upon those who support the extension of price fixing to this field and who believe that the practice is administratively feasible. For four years the Federal government has been fixing maxima in connection with certain banking costs. It is becoming increasingly important that the principles for determining those maxima be stated.

In conclusion, it appears to me that if banking is to remain a private-profit enterprise, bank supervision should be largely confined to requiring that a reasonable proportion of banking funds be supplied by owners and that bank assets conform to minimum quality standards.

NEW INDEXES OF PRODUCTION AND TRADE

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WORK has recently been completed upon a broad new measure of fluctuations in the physical volume of business, supplanting the indexes of the Volume of Trade formerly computed.¹ The new index, calculated monthly from 1919 to date and expressed in relationship to estimated long term trend, is designed as a measure of production (including construction), together with trade in newly-produced goods and services.

The general lines of composition and weight distribution of the index, called the index of Production and Trade, are indicated in Table I. As a general rule, the series entering into the index are adjusted individually for seasonal variation and estimated long term trend, although in some instances two or more related series are combined before adjustment. Dollar series are adjusted for price changes, or "deflated," where necessary, but the use of series requiring such adjustment has been minimized.² Moving averages have been employed in some instances to meet special problems. For example, a six months' moving average placed at the sixth month is applied to construction contracts, inasmuch as actual construction work during any given month is dependent on contracts let during preceding months as well as upon contracts let during the month itself.

There are four main group indexes, Production, Primary Distribution, Distribution to Consumer, and Miscellaneous Services. In addition, production series are broken down into four parts—producers' durable, producers' nondurable, consumers' durable, and consumers' nondurable goods. This split permits the calculation of indexes of Consumers' Goods and Producers' Goods, and Durable Goods and Nondurable Goods. The number of series embraced in the total index was appreciably smaller at the beginning than now—the number increasing from about 60 in 1919 to 82 at the present time. This less adequate coverage in the earlier years should be kept in mind particularly in interpreting the subordinate indexes.

¹ See Carl Snyder and Leroy M. Piser, "The Index of the Volume of Trade. Third Revision," this JOURNAL, volume 20 (1931), pp. 436-442.

The differences between the indexes formerly computed and those described in this article appear most conspicuously in the weighting structure. In addition, there are numerous changes in composition, in subordinate indexes derived, in measurements of trend and seasonal variation, and in price adjustments. No effort is made in the new indexes to include "financial activity," and the total index, called the index of Production and Trade, in this respect corresponds most closely to the former Volume of Trade III index.

² Weights of deflated series total 25.9 (out of 100) in the total index. The most important deflated series are construction contracts and department store sales.

TABLE I
CURRENT COMPONENT INDEXES, WEIGHTS,
AND NUMBER OF SERIES

	<i>Weights</i>	<i>Number of Series</i>
A. Production		
1. Producers' Goods*	23 2	30
2. Consumers' Goods*	23 2	30
3. Employee-hours, manufacturing	8 6	1
	<hr/> 55 0	<hr/> 61
B. Primary Distribution		
1. Car loadings, merchandise & miscellaneous	9 0	1
2. Car loadings, other	2 5	1
3. Waterway traffic	0 2	4
4. Exports	2 2	1
5. Imports	2 0	1
6. Wholesale grocery sales	0.2	1
	<hr/> 16.1	<hr/> 9
C. Distribution to Consumer		
1. Department store sales	8 9	1
2. Chain grocery sales	5.1	1
3. Chain sales other than grocery	3 5	1
4. Mail order house sales	2 9	1
5. Gasoline consumption	3 2	1
6. New passenger car registrations	2 4	1
	<hr/> 26.0	<hr/> 6
D. Miscellaneous Services		
1. Advertising lineage	1.0	2
2. Postal receipts	0 5	1
3. Communication	0.6	1
4. Commutation railway passenger-miles	0.2	1
5. Other railway passenger-miles	0.6	1
	<hr/> 2 9	<hr/> 6
	100.0	82

* The 60 series entering into Producers' Goods and Consumers' Goods are also classified into Durable Goods and Nondurable Goods

Table II gives the total index monthly from 1919 to date. Because of space limitations the various subordinate indexes are not presented here, but releases covering them are available upon application.

THE WEIGHTING BASIS

In deriving weights use has been made of the considerable new data which have become available for this purpose, and a system of secularly changing weights has been set up. The results of eight or nine biennial Censuses of Manufactures are now available beginning in 1919; censuses of distribution, both wholesale and retail, and of other non-

TABLE II
NEW INDEX OF PRODUCTION AND TRADE
100 = estimated long term trend

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Average
1919	108	103	100	102	102	106	110	108	111	107	109	110	106
1920	111	108	108	103	104	105	104	102	98	95	95	91	102
1921	87	85	85	85	87	88	87	89	88	90	89	89	87
1922	91	92	96	95	99	101	101	100	101	103	106	107	99
1923	108	107	109	111	111	109	108	106	104	105	104	104	107
1924	105	106	103	103	100	97	96	98	101	102	104	105	102
1925	107	106	106	106	105	105	106	106	106	109	110	113	107
1926	111	109	109	109	108	108	109	110	110	110	110	110	110
1927	109	109	110	109	109	108	107	108	106	105	105	103	107
1928	106	107	107	105	107	106	108	109	111	112	113	113	109
1929	113	114	113	112	113	114	115	115	114	112	107	104	112
1930	103	103	100	100	99	96	94	93	92	90	88	86	95
1931	86	87	87	89	87	85	85	82	80	78	77	76	83
1932	74	73	70	68	66	65	63	64	67	68	67	65	67
1933	65	64	60	65	71	77	79	77	74	72	70	71	70
1934	72	74	76	75	76	74	71	72	70	71	72	74	73
1935	76	76	76	74	74	75	75	77	78	81	82	84	77
1936	83	82	82	84	86	87	89	90	89	91	93	96	88
1937	93	94	95	94	94	92	93	93	91	88	83	80	91
1938	77	75	75	—	—	—	—	—	—	—	—	—	—

manufacturing lines of business have been instituted;³ and improved and more comprehensive estimates of the total volume of construction have recently been made.

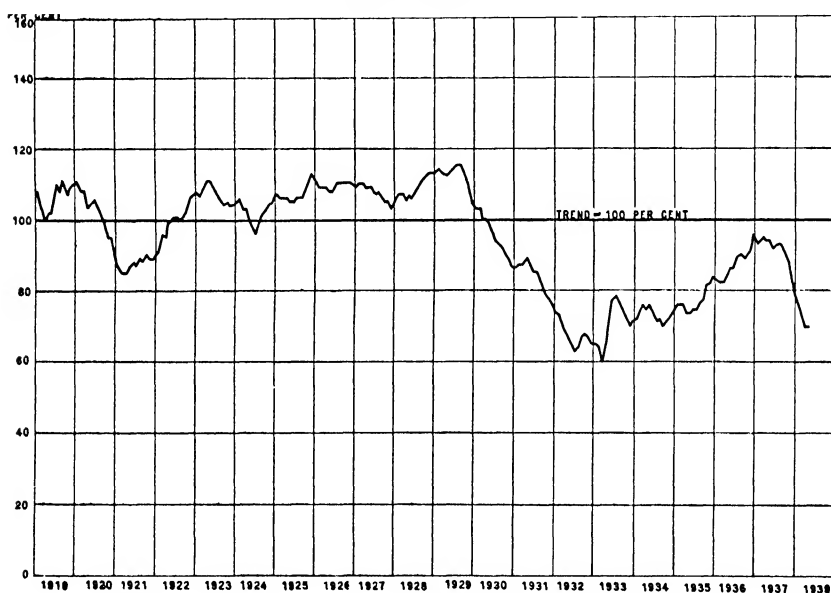
In assigning weights the underlying basis has been total values in trade, but the factor of judgment enters heavily into the decision as to what values to apply to particular series. If values used were actual values of series included, supposing those values to be available, it would be assumed that all other activities were "covered" by general imputation; that is, it would be assumed that the total index thus weighted would reflect as well as anything activities not directly measured. The *general* imputation at best rests on the logical ground that a particular unmeasured activity, or a combination of many unmeasured activities, may follow in a general way the composite of measured activities, and at worst it is a confession that certain activities are not and cannot be included. In many cases, however, there is a strong presumption that certain unmeasured activities are more closely related to particular measured activities than to the total index as it otherwise would be derived, and a direct imputation is made. In other words, the values applied to the individual series are built up, where the quality of the latter seems to justify it, to take account of related activities which are not represented.

³ For an account of some of the new work of the Bureau of the Census, see F. A. Gosnell, "Highlights of the 1935 Census of Business," this JOURNAL, volume 32 (1937), pp. 263-270.

CHANGING WEIGHTS

Changing weights are used to give effect to the changing importance, in a gradual secular sense, of individual branches of production and trade.⁴ If weights were permitted to change *cyclically* they would exaggerate positive deviations from trend and minimize negative ones. The correction would be of less consequence if all series had the same and simultaneous cyclical deviations, but needless to say this is not even approximately true.

CHART I
INDEX OF PRODUCTION AND TRADE IN THE UNITED STATES SINCE 1919
(Seasonally adjusted)



Flexibility of the weight structure, of course, becomes vital with a fairly extended time span. To take two conspicuous examples, anthracite coal is now very much *less* important in our economic life than at the beginning of our nineteen year period, and electrical energy has become very much *more* important. The dollar volume of anthracite coal production exceeded \$500,000,000 in 1923; thirteen years later it had fallen to \$226,000,000. The value of electric power generated, under \$1,000,000,000 in 1922, had exceeded \$2,000,000,000 by 1936. While figures for these particular years may reflect special factors,

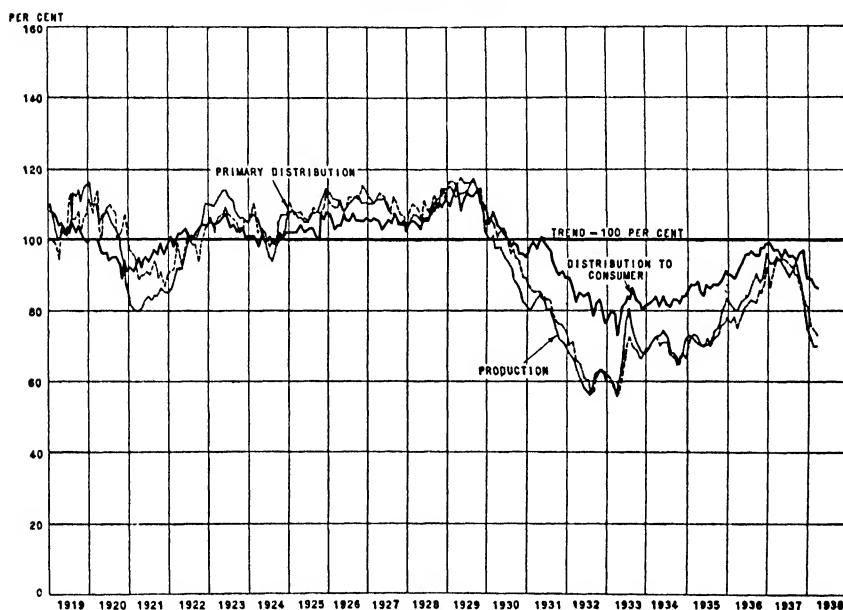
⁴ In addition, readjustments in weights have been made to make room for new series. The entrances of new series do not, generally speaking, create artificial movements of the indexes at the points of entrance, but they naturally modify the characteristics of the indexes to some extent.

which must be discounted in the determination of actual weights, the underlying trends are unmistakable.

TRENDS

The fitting of a trend is always a matter requiring discrimination, and at the present time, after the lapse of so many years since our business volumes have given an indication of their capacity, or near capacity performance, the problem is especially difficult. In the present

CHART II
PRINCIPAL GROUP INDEXES INCLUDED IN INDEX OF PRODUCTION AND TRADE
(Seasonally adjusted)



study, care has been taken to consider not only the record of each series itself, but also supplementary information concerning the industry and the performance of related data. The general concept of trend position which has been employed will be apparent from a study of the indexes themselves, expressed as they are in terms of estimated trend.

In trend fitting numerous applications have been made of the curve, $y = bc^{1/(d+x)}$, originally presented in this JOURNAL in December, 1935.⁵ This curve increases at a constantly decreasing percentage rate, and can be applied with unusual facility. It met a problem which had arisen in connection with the parabolic functions formerly employed to a

⁵ Volume 30 (1935), p. 717. For short-cut calculation see also volume 31 (1936), p. 731.

considerable extent. Parabolas, though acceptable for trends over parts of their ranges, approach turning points if used long enough, and, aside from the danger in predicting or anticipating when and if turning points are going to occur, the behavior of a parabola after the turning point has been passed is usually irrational in these applications.

INTERPRETATION

While the subordinate indexes are set up on the basis of the successive stages, Production of Producers' Goods, Production of Consumers' Goods, Primary Distribution, and Distribution to Consumer, they do not portray the flow of identical goods through successive steps from raw materials to finished goods in the hands of the consumer. In theory we might like to have measures of (1) production of raw and semi-finished goods, (2) production of finished consumers' goods, (3) wholesale distribution of consumers' goods, and (4) retail distribution. Unfortunately, our economic structure itself, no less than available statistics, would limit the significance of such results. Many goods are produced which become capital equipment of producers, and the inclusion of these as producers' goods introduces a factor of durable capital formation and eliminates the possibility of appraising changes in inventory position by comparing Producers' Goods Production and Consumers' Goods Production. Moreover, consumers' goods often pass directly from manufacturer to retailer, without the intervention of wholesale intermediaries; they may even, as in the case of residential construction, pass directly from producer to consumer without the intervention of any middleman. And aside from these institutional complications, there is seldom a basis, in available statistical data, for lining up even certain classes of goods and following them through successive stages of production and distribution. These circumstances do not make it useless to seek measures of the flow of goods and services at certain important points, but they require us to keep in mind that all goods do not pass through all four stages, and that, even for goods that do, there are few cases where statistics are at hand to observe the flow from month to month at all four stages.

The physical volume of trade in consumers' goods by wholesale intermediaries cannot be accurately measured on the basis of available data, and even if it could the results would not be comparable with broad indexes either of consumers' goods production or of retail distribution because so many goods by-pass wholesale middlemen. In this study, wholesale distribution has been measured in the broad sense including sales of producers to other producers and traders, thus including primary distribution not only of producers' goods, but also of

some consumers' goods which do not pass through a separate classification of middleman. This measurement is obtained largely from railway freight traffic. To emphasize the breadth of interpretation of wholesale distribution, the resultant index is called Primary Distribution.

The most promising comparison between the various subordinate indexes from the standpoint of evaluating an inventory position, might appear to be between Production of Consumers' Goods and Distribution to Consumer. But even here the composition of the two indexes is not similar enough to permit accurate deductions as to inventory changes. Production of Consumers' Goods includes residential construction, household electricity sales, anthracite coal production, and newsprint paper consumption, none of which is represented in Distribution to Consumer. Other production series, tobacco manufacturing and meat-packing, for example, are inadequately represented in Distribution to Consumer. On the other hand, Distribution to Consumer reflects the distribution of women's apparel and a wide variety of products whose production is not measured. Passenger cars, and gasoline are two items which are quite fully covered in both indexes, but even in such cases discrepancies would not accurately reflect inventory changes without making an adjustment for exports (or imports).

There are two possible viewpoints which might have been taken in working out the subordinate indexes: (1) the items might have been made as nearly identical as possible; or (2) each index might have been made as broad as available data permit. Adoption of the first viewpoint would have meant seriously restricting the coverage not only of the subordinate indexes themselves but also of the index of Production and Trade as a whole. Adoption of the second viewpoint, the course actually followed, means losing the advantage of close comparability between subordinate indexes, but it is not believed, for reasons cited above, that the alternative procedure would have yielded results of broad significance.

The major objective in this study has been the total index, of Production and Trade, and the subordinate indexes, which might have been narrowed to improve comparability for special purposes, have been placed upon broad foundations, not only to make them individually as representative as possible, but also to make them contribute as much as possible to the total index.

ACCURACY AND INCLUSIVENESS OF INDEXES

Considerable gaps still exist in the available data, such as in the

service industries which have become so important a feature of our economic life, and in lines like the machinery industry, where the product, while "physical," is not of uniform size or quality and therefore does not accommodate itself to numerical count.⁶ We also make use of many physical counts which are to some degree biased by non-uniformity in the units counted, as in measuring automobile production in numbers of cars, and it is not safe to underrate either the areas of economic activity that are not measured at all or the errors that are involved in the measurements actually used. Nevertheless, the raw material supply of statisticians has enjoyed a noteworthy expansion in the past twenty years; and each widening of the statistical basis renders our tentative generalizations more and more free from the idiosyncrasies which we know to affect individual series.⁷

⁶ The series of employee-hours worked in manufacturing industries serves a double purpose, as a supplemental measure of factory production, and as a measure of employment (including the degree of employment of employed workers) in this field. In so far as labor input is correlated with production, this treatment affords some coverage for industries where production is not measured directly.

⁷ These indexes are the work of the Research Section of the Federal Reserve Bank of New York, and especially of Alice L. Carlson, Eloise W. Lane, Mary Crandall, Inglis Winsor, Jane L. Wagner, and Lucile Bagwell.

A QUARTERLY SERIES OF MANUFACTURERS' INVENTORIES

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THE quarterly series on dollar inventories in manufacturers' hands, shown in Table II below, was constructed in November of last year and was subsequently continued through December 31, 1937, the latest date available at this writing. The purpose was to ascertain if there might be a connection between the trend of manufacturers' inventories and the extreme rapidity of the decline in general manufacturing activity during the last quarter of 1937. While various series on inventories were already available, it was felt that a series confined to inventories reported on the balance sheets of manufacturing companies might give additional light on the particular problem indicated.

Unfortunately, very few industrial corporations publish quarterly balance sheets regularly, and it was therefore impossible to construct any sort of comprehensive series. In fact, the 50 concerns used include practically all the manufacturing corporations for which quarterly inventories were available in 1936 and 1937. (Because of incomplete data, the series was not extended further back than 1936 except for year-end figures.) While this is a small sample indeed, the group is sufficiently representative to indicate at least the general trend of dollar inventories in manufacturers' hands. Evidence of this is found in Table I below, which compares year-end figures of the 50 companies back to 1929 with those of another group of 487 large and thoroughly representative manufacturing corporations. It will be noted that the fluctuations in the two groups are similar.

TABLE I
INVENTORIES OF MANUFACTURING CORPORATIONS

Comparison of Two Series (In thousands of dollars)		
<i>End of year</i>	<i>487 companies</i>	<i>50 companies</i>
1929	\$4,234,935	\$226,035
1930	3,856,091	186,041
1931	3,221,250	148,397
1932	2,656,048	119,891
1933	3,011,975	150,809
1934	3,298,343	166,436
1935	3,558,600	194,023
1936	4,097,442	238,928
1937	4,780,865	266,992

The complete figures for the 50 manufacturing companies are given in Table II. Inventories for General Motors are shown separately, as they would be given too much weight if included in the group.

TABLE II
INVENTORIES OF 50 MANUFACTURING COMPANIES BY QUARTERS,
AND FOR PAST YEARS
(in thousands of dollars)

	10 companies with assets of over \$35,000,000	15 companies with assets between \$10,000,000 and \$35,000,000	25 companies with assets between \$1,000,000 and \$10,000,000	Total 50 companies	General Motors
TOTAL ASSETS September 30, 1937	\$893,100	\$288,700	\$148,500	\$1,330,300	\$1,617,000
INVENTORIES					
1928—December 31	128,518	49,042	28,995	206,555	196,693
1929—December 31	143,584	49,111	33,340	226,035	188,473
1930—December 31	116,027	43,436	27,178	186,641	136,299
1931—December 31	93,920	33,081	21,396	148,397	106,471
1932—December 31	77,574	25,112	17,205	119,891	75,479
1933—December 31	98,713	31,744	20,352	150,809	115,585
1934—December 31	113,034	31,017	22,885	166,936	138,598
1935—December 31	134,809	33,329	25,885	194,023	196,325
1936—March 31	128,497	33,333	27,697	189,527	193,755
1936—June 30	118,823	34,124	29,803	182,750	166,432
1936—September 30	130,061	35,360	31,717	197,138	165,848
1936—December 31	166,893	39,924	32,111	238,928	225,045
1937—March 31	172,047	45,097	36,261	253,405	253,591
1937—June 30	167,512	48,930	39,995	256,437	245,071
1937—September 30	192,723	50,580	42,303	285,606	263,845
1937—December 31	180,778	48,050	38,164	266,992	279,146
PERCENTAGE GAIN					
Dec 31, 1936 over Dec 31, 1935	23 8	19 8	24 1	23 1	14 9
March 31, 1937 over March 31, 1936	34 6	35 3	30 9	33 7	30 9
June 30, 1937 over June 30, 1936	41 0	43 4	34 2	40 3	47 3
Sept 30, 1937 over Sept 30, 1936	48 1	43 0	33 4	44 9	59 1
Dec 31, 1937 over Dec 31, 1936	8 3	20 4	18 8	11 8	23 7

In analyzing Table II, the first point to consider is that the figures are in dollars, and that consequently the price factor must always be kept in mind. The writer has tried various methods of correcting the series for price fluctuations, but none seemed entirely satisfactory because of the numerous difficulties involved. For instance, raw materials, which constitute an important part of total inventories, are not usually purchased all at once, but over a period of time; thus, having chosen a particular price index for the purpose of correcting the inventory figure for any given date, what month or months of the price index shall be used? Again, there are various methods of valuing inventories. Most companies report them at "lower of cost or market," which means that a declining price trend is reflected more quickly in the dollar value than a rising price trend. But some concerns use other methods, such as "base stock" and "inventory reserve," which affect both the value of inventories and the amount of operating profit or loss arising from inventory price fluctuations.

Any exact correction of dollar inventory figures for price changes is

therefore impossible. As an approximation, perhaps the use of the wholesale price index of non-agricultural commodities (Bureau of Labor Statistics) is as satisfactory as any; but the results should be applied with caution, except in general terms. With the price qualification in mind, the trend of inventories appearing on Table II will be examined.

The most striking feature of the table is the rapid rise in dollar inventories in the first nine months of 1937. There had been a steady increase from 1932 through 1935, as would be expected in a period of business recovery and rising prices. There was a very substantial advance in the latter part of 1936; but that year witnessed a 17 per cent gain over 1935 in industrial production as well as a more moderate price rise, so that the increase in inventories was still hardly excessive.

In 1937, however, the inventory series up to September 30 registered a gain considerably more rapid than that of industrial production or prices. The September 30 figure reached a peak of \$285,606,000—the highest for any date used in the series; 26 per cent higher than at the end of 1929; and 45 per cent higher than on September 30, 1936.

Part of the above rise was obviously due to higher material prices and labor costs. The non-agricultural price index of the Bureau of Labor Statistics, for example, rose from 80.9 for September, 1936, to 87.6 for September, 1937. It is certainly most unlikely, however, that all of the sharp advance in inventory figures can be explained on these grounds. The 45 per cent gain in one twelve-month period must have involved a considerable increase in physical inventories as well as in their value per unit. The case of General Motors offers some evidence on this point; that company has estimated that of the \$53,500,000 increase in its inventories between the end of 1936 and the end of 1937, about \$32,000,000 was caused by the increased cost of materials and labor.

It can thus be reasonably assumed that the physical volume of inventories in manufacturers' hands did increase sizeably in 1937. It is not proposed to discuss why this took place; but for whatever reasons, inventories were at a high peak at the end of the third quarter, at the very time when the usual fall recovery was not materializing and when the curve of business activity was commencing its rapid decline. In such a situation, many concerns found their inventory position top-heavy. The natural course was to restrict their purchases until their own stocks could be reduced to more manageable levels; and this process would work back to primary producers, whose new orders would then quickly dwindle. This sort of a sequence would logically help to explain the almost complete collapse in steel activity, which

experienced a drop even more precipitate than that of industrial production as a whole.

As to the period since September, 1937, there appears to have been a gradual improvement in the inventory situation. The drop of nearly \$19,000,000 between September 30 and December 31, as shown on Table II, included losses taken by year-end write-downs; but there was doubtless some physical reduction as well. Further reductions will probably show up for the first quarter of 1938 when the March 31st figures become available.¹

In conclusion, the rise in manufacturers' inventories was only one of many developments affecting the trend of business during 1937; but it seems reasonably clear that the rapidity of this rise in the first nine months of 1937 was a factor in the rapidity of the business decline in the fourth quarter.

¹ Later information, covering the first 29 companies of the group to report March 31st figures, shows that inventories of these 29 companies were \$144,675,000 on March 31, 1938, as compared with \$153,490,000 on December 31, 1937, and \$139,972,000 on March 31, 1937

PROBLEMS IN THE COMPILATION OF DATA ON TOTAL RELIEF AND WORK PROGRAM EXPENDITURES*

BY DOROTHY FAHS BECK

*Central Statistical Board and Special Committee to Investigate
Unemployment and Relief, United States Senate*

THE SPECIAL COMMITTEE of the Senate to Investigate Unemployment and Relief was appointed and began its studies in the summer of 1937.¹ Within the limits of its resources, the Committee and its staff have undertaken to assemble some of the more essential data on such subjects as the extent and trends of unemployment, the costs of relief and emergency public employment programs, the number of persons or families receiving assistance of various types, the ability of States and localities to finance relief, the functioning of unemployment insurance systems, the causes of both urban unemployment and rural poverty, and the most effective means of dealing with these varied problems.

For help in the compilation of pertinent information, the Senate Committee has called upon industrial and labor leaders, private and public municipal and State agencies, and a large number of agencies or bureaus of the Federal Government. Because of the problem of statistical coordination involved in an analysis of relief costs, the chairman of the Central Statistical Board was requested to provide assistance in assembling data on total public expenditures for relief and emergency employment programs during the five-year period, 1933 to 1937 inclusive. As a result of this request, the services of the author were loaned to the Committee for this purpose.

The detailed final results of the compilation of data on total expenditures for the relief of destitution and unemployment are to be made available to the general public in the published hearings of the Senate Committee. These hearings will also contain the testimony of Dr. Stuart A. Rice, Chairman of the Central Statistical Board, regarding the major trends which the data indicate and some of their implications.² For this reason this account will be confined largely to a discus-

* This paper is adapted from a paper on "Consolidated Statistics of Relief Expenditures Since 1933" presented by the author on December 29, 1937, at the annual convention of the American Statistical Association held at Atlantic City, N. J.

¹ This Committee was appointed pursuant to Senate Resolution 36, agreed to on June 10, 1937. The following Senators were appointed to membership. James F. Byrnes (S. C.), Chairman; Bennett Champ Clark (Mo.), Carl A. Hatch (N. M.), James E. Murray (Mont.) (Democrats), James J. Davis (Pa.), Lynn J. Frazier (N. D.), and Henry Cabot Lodge, Jr. (Mass.) (Republicans).

² Dr. Stuart A. Rice testified on this subject at an open hearing of the Special Committee of the Senate to Investigate Unemployment and Relief on March 15, 1938. Dr. Rice's testimony, together

sion of the problems of methodology and statistical coordination and comparability which arose in the course of the project.

In order to indicate very briefly the general nature of the inquiry and some of the major findings, two summary tables are reproduced here. The first table presents the final totals by source of funds. The second table indicates by half-year periods the costs of the various programs included in the totals.

As will be noted, all the data pertain to total costs. The interest of the Committee in relief financing led at the outset to the decision that the series should include all types of costs, including those incurred for pay rolls of all types, administration, materials, rent, land, and other items essential to the programs included in the series. In order to determine the extent to which published sources could be used to meet this and other needs of the Committee, a preliminary search of available data was made. This examination revealed that most of the consolidated series relative to expenditures for relief and emergency-employment programs were of one of two types: either they included only the amounts actually extended to persons considered in need of relief, or they included in addition to these amounts only the earnings of nonrelief employees on work programs with a relief emphasis. Seven statistical series presenting integrated data on relief expenditures on all levels of government for sample areas or for the United States as a whole were found to have been compiled by either the Works Progress Administration or the Social Security Board in cooperation with other agencies.³ Of these seven series, four were still being currently released

with copies of the large charts presented by him, will be published in Volume 2 of the *Hearings before a Special Committee to Investigate Unemployment and Relief, United States Senate*. Appendix 1 of this volume will contain the complete tables and full explanatory notes and technical specifications. This volume will probably be available by the time this issue of the JOURNAL is off the press. Until the supply is exhausted, these hearings can be secured without charge by addressing a request to the Special Committee to Investigate Unemployment and Relief, United States Senate, Senate Office Building, Washington, D. C.

* The seven compilations of data on relief expenditures referred to are to be found in the following sources: (1) monthly memoranda on relief prepared since June 1937 by the Works Progress Administration for administrative use and for limited distribution, (2) summaries of relief, public assistance, and Works Program data published monthly by the Social Security Board in the *Social Security Bulletin*, (3) the urban relief series now included in the *Social Security Bulletin*, but which was formerly published by the Children's Bureau, (4) the series on relief in rural and town areas now published by the Social Security Board in this same bulletin, but which was initiated and carried on for a considerable period by the Works Progress Administration, (5) *Trends in Relief Expenditures 1910-1935* by Miss Anne E. Geddes, a research monograph published by the Works Progress Administration, (6) special analyses of differences between urban and rural trends now in preparation by the Works Progress Administration, and (7) an annual series on total relief costs through 1936 first presented at the House *Hearings on the Emergency Relief Appropriation Act of 1937* and later republished in the June 1937 issue of the *Report on Progress of the Works Program*. (After the initiation of the Senate Committee project, a revised form of this series restricted to "security programs" was republished in half-year time units in the December 1937 issue of the *Report on Progress of the Works Program* and in the January 1938 House *Hearings on the Supplemental Appropriation for Relief and Work Relief*, fiscal year 1938.) Other composite data with a smaller coverage or less regular periodicity have also appeared from time to time.

TABLE I
TOTAL COSTS OF RELIEF, PUBLIC ASSISTANCE, FEDERAL WORK PROGRAMS,
AND EMERGENCY PUBLIC WORKS*

By Source of Funds
(in thousands of dollars)

Time period	Total—all public sources of funds	Federal funds	State and local funds		
			Total	Funds bor- rowed from the Federal Government	Funds se- cured from other sources
Total 1933-1937	\$19,303,409	\$14,218,773	\$5,084,636	\$705,908	\$4,378,728
1933					
January-June	610,158	389,983	220,175	13,358	206,817
July-December	993,729	744,051	249,678	29,932	219,746
1934					
January-June	1,930,624	1,555,630	374,994	45,648	329,346
July-December	2,013,350	1,597,080	416,270	83,574	332,696
1935					
January-June	1,976,350	1,529,617	446,733	76,100	370,633
July-December	2,015,847	1,525,245	490,602	106,122	384,480
1936					
January-June	2,627,555	1,932,135	695,420	110,393	585,027
July-December	2,677,170	1,928,584	748,586	105,929	642,657
1937					
January-June	2,463,167	1,747,406	715,761	73,596	642,165
July-December	1,995,459	1,269,042	726,417	61,256	665,161

* The data include expenditures for pay rolls of all types, materials, administration, and all other costs incident to the programs included in the series with certain minor exceptions noted in the original source. For explanatory notes on component programs and all technical specifications applicable to these data, see Volume 2, *Hearings before a Special Committee to Investigate Unemployment and Relief*, United States Senate, Appendix 1

at the time of the initiation of this project. Six of these series, however, omitted materials and administrative costs. The only series compiled on a total costs basis was prepared and published by the Works Progress Administration.⁴ The coverage of this series was narrower with respect to both the programs and geographic areas included than that desired by the Committee, and the classification was based on the identity of the agencies concerned rather than on the types of programs involved. In these and other respects the series did not meet fully the need of the Committee for data having both a wide coverage and an abundance of detail as to individual items. An independent compilation was, therefore, considered desirable.

Since the allocation of the burden of relief costs as between the tax resources of Federal, State, and local governments has long been a central theme of legislative discussions of relief policies, it was further the wish of the Committee that the compilation include not only Federal expenditures but also State and local expenditures for similar activities. The data for most of the items in the tables had to be

⁴ This series is listed as series seven in the preceding footnote which indicates sources.

secured, therefore, from the Federal administrative agencies involved rather than from the central fiscal records, since only from this source could data be obtained which would permit the simultaneous presentation of trends on all levels of government. If only the picture of Federal expenditures had been desired, an exact accounting statement of total agency expenditures could have been obtained from the United States Treasury or from the General Accounting Office. Even in this case, however, the functional split of a single agency's expenditures along lines desired by the Committee would in some cases have proved a difficult undertaking for the Treasury or for the General Accounting Office. For this reason the primary data were secured wherever feasible from the agency directly administering the program. Where needed, the Treasury data were utilized as a supplementary source of information on Federal expenditures and as a tool to assist in analyzing the data submitted by the agencies. In each case the agency responsible for a given Federal program undertook to provide information on State and local funds spent in conjunction with Federal funds. Fortunately for this purpose, the Federal Emergency Relief Administration, the Works Progress Administration, and certain other Federal agencies responsible for programs in which State and local participation has been important have emphasized consistently a source-of-funds classification in their statistical reports. In these cases the type of data needed was readily available. In the case of some other programs, however, estimates had to be resorted to in order to secure a time series by source of funds of the type required. In this manner that problem of splicing together information on various levels of government which is paramount to all studies of this type was solved, in so far as the problem is believed capable of solution on the basis of existing statistical reports in this field.

The decision to secure the data in most cases from the individual administrative agencies responsible for programs necessitated personal contacts with twenty-nine Federal agencies or bureaus.⁵ Most of the other problems which arose were inherent in the process of collecting from this large number of agencies financial statistics for use in a framework not previously standardized. The great majority of the agencies included in the tabulation maintain an abundance of statistical and financial records regarding their own operations. Because of the divi-

⁵ This number represents the total number of Federal agencies or bureaus from whom data were secured by direct contact. The total number of agencies or bureaus included in the tabulation was between three and four times this number. Reports on the remaining agencies were secured either from published Treasury reports or from the Federal Emergency Administration of Public Works. This more indirect approach was used only in the case of agencies or bureaus whose programs involved no financial participation from State and local governments and whose expenditures were to be grouped with those of many other agencies as a miscellaneous item under "emergency public works."

sion of administrative responsibility for relief and work programs, however, relatively little attention has been devoted to establishing interagency comparability in these reporting systems. For this reason the development of consolidated tables of the type desired for the use of the Committee proved much more difficult than was at first anticipated.

One of the first issues to arise related to the limits to be established for the scope of the tabulation. It became urgent to determine, for example, what programs were to be defined as relief programs, or were sufficiently related to relief activities to be considered in conjunction with relief expenditures. A further decision was necessary as to the feasibility or desirability of limiting the tabulation to expenditures of an emergency character associated with depression conditions. Except in the case of public works, the final totals include, in so far as possible, both regular and emergency expenditures in this general field. After some experimentation the title, "total costs of relief, public assistance, Federal work programs, and emergency public works" was selected for the compilation. The multiple title itself indicates to some extent the manner in which the concept of relief shades off on all sides into closely related activities. Some types of farm loans, public works construction activities, educational aid, public health programs, assistance to veterans, recovery loans to industries and financial institutions, and purchases of surplus agricultural commodities may be said to represent activities at least borderline to relief, public welfare, or recovery measures in the broad sense. Agencies responsible for activities bordering on the scope of the tabulation sometimes contended for the omission of their programs on the grounds that they did not constitute "relief" and that placing them in a "relief" context would affect unfavorably the future position of the agency. On the other hand, agencies whose programs were obviously to be included wished in most cases that the scope of the table be made as broad as possible. The compromises finally agreed upon probably err on the side of too extensive rather than too narrow a coverage.⁶ At least the scope is broader than that of any previous tabulation of this type, a fact which is reflected in the relatively large final totals. This breadth of scope was purposely provided for, since it was considered essential that relief trends, strictly considered, be interpreted at all times in the light of trends in emer-

⁶ Of the various debatable items, probably the most significant from the point of view of magnitude is the inclusion in the totals of expenditures for emergency public works from funds provided under the National Industrial Recovery Act. Under this program the Federal Government made no formal requirement that employment be restricted to persons in need of relief. Since many of the projects initiated with these funds were later continued with Works Program funds under employment policies requiring high percentages of relief labor, the inclusion of these early emergency public works programs seemed essential to a sound perspective on trends.

TABLE II (Continued)

Type of Program	Total	1933		1934		1935		1936		1937	
		Jan-June	July-Dec	Jan-June	July-Dec	Jan-June	July-Dec	Jan-June	July-Dec	Jan-June	July-Dec
V. Rehabilitation loans to destitute and low-income farmers	231,281	—	—	1,563	7,118	46,761	15,773	90,270	10,581	59,257	42†
A. F.E.R.A. and State rural rehabilitation corporations											
1. Amounts loaned	80,038	—	—	1,563	7,118	49,243	9,103	7,185	4,020	1,427	379
2. Amounts repaid (<i>deduct</i>)	15,803	—	—	—	—	2,598	4,597	2,565	2,798	1,633	1,642
3. Net disbursements	64,235	—	—	1,563	7,118	46,675	4,506	4,620	1,222	204†	1,263†
B. Farm Security Administration											
1. Amounts loaned	162,011	—	—	—	—	—	7,907	72,106	15,210	55,568	11,220
2. Amounts repaid (<i>deduct</i>)	42,647	—	—	—	—	—	17,879	—	17,537	5,425	17,806
3. Net disbursements	119,364	—	—	—	—	—	6,028	72,106	2,327†	50,143	6,586†
C. Other costs of rural rehabilitation program (Farm Security Administration)	47,682	—	—	—	—	86	5,239	13,544	11,686	9,320	7,807
VI. Emergency public works	5,390,352	72,358	166,802	411,850	641,743	478,877	634,826	794,583	958,904	678,082	552,327
A. Public Works Administration											
1. Non-Federal projects (grants, collateral loans, and sponsors' contributions)	1,848,865	—	7,369	53,681	143,225	133,652	195,120	341,938	421,144	287,929	264,807
2. Federal low-cost housing projects	112,348	—	—	654	1,266	6,893	14,077	8,576	18,853	31,795	30,234
3. Other P.W.A. costs	83,155	—	1,467	4,625	6,849	8,653	11,327	14,596	15,166	11,850	8,622
B. Bureau of Public Roads (emergency funds)	1,144,565	59,000	74,307	133,429	200,773	100,648	130,710	94,249	186,148	98,960	66,341
C. Resettlement housing and land development projects of the Farm Security Administration	178,719	—	—	—	—	842	7,755	25,480	46,633	57,987	40,022
D. Projects of other Federal agencies (including miscellaneous non-construction projects)	1,762,028	—	56,501	194,019	259,967	202,397	242,113	279,738	242,357	161,546	123,390
E. Federal loans for public construction (except under the P.W.A.)											
1. Self-liquidating loans of the Reconstruction Finance Corporation (Act of 1932)	258,817	13,358	27,158	25,442	29,663	25,792	33,724	29,990	28,141	27,067	18,482
2. Other loans	1,855	—	—	—	—	—	—	16	462	946	429
VII. Surplus commodities distributed for relief‡	426,304	30,469	35,640	50,931	184,890	80,061	11,823	5,898	7,015	11,272	8,305

* The data include expenditures from Federal, State, and local public funds for all types of costs incurred in conjunction with programs listed. Payrolls, materials, administration, and all other items are included with certain minor exceptions noted in the original source. For explanatory notes on component programs, and all technical specifications applicable to these data, see Volume 2, *Harvesting before a Special Committee to Investigate Unemployment and Relief*, United States Senate, Appendix 1.

† Data for sponsors' contributions to National Youth Administration work projects for July to December, 1937, are not yet available.

‡ Excess of credits, deduct.

§ This item includes the cost of wheat and cotton purchased with Federal funds and donated to the Red Cross for relief distribution, the purchase and distribution of surplus commodities by the Federal Surplus Relief Corporation, and the Federal Surplus Commodities Corporation, purchased by the Agricultural Adjustment Administration of commodities utilized for relief purposes (including the 1934 drought purchase program) and the costs to the Federal Emergency Relief Administration of the care and processing of drought cattle for relief use. Details as to expenditures on these component programs are omitted here because of the limitations of space but can be found in the original source cited in footnote*.

gency public works, which have so frequently represented an immediate alternative to relief grants. It will be noted in Table II that totals which exclude emergency public works and surplus commodities are provided to enable the reader to study trends in a more delimited field.

A third type of problem was associated with the development of a classification by type of program. In the attempt to portray developments over a five-year span, during which many changes in relief agencies and policies have taken place, it seemed important to think of trends in terms of major functional changes rather than in terms of the more fleeting organizational transfers. Only in this manner could the problems involved be seen in their larger outlines. As is usually the case, the effort to see major changes involves oversimplification and arbitrary decisions. In order to establish sharp lines of demarcation between major classes, some of the individuality of agencies' objectives and programs necessarily had to be subordinated, since it did not appear feasible to provide special categories for all shades of programs ranging from direct relief on a very meager level to emergency employment without a means test. If a miscellaneous classification without meaning or practical value were to be avoided, miscellaneous borderline programs, particularly those of small magnitude, had to be placed under headings to which they had some similarity.

A number of alternative principles of classification were also suggested. Because of lack of data most of these proved impractical. A relatively simple list of classes conforming to no single principle of organization was finally adopted. The classification, however, follows in general the form of assistance characteristic of the programs included. The seven major headings utilized are as follows: (1) general relief, (2) Federal work programs primarily designed to employ relief labor, (3) work program of the Civilian Conservation Corps, (4) specialized types of assistance to unemployables (aid to the aged, the blind, and dependent children), (5) loans to destitute and low-income farmers, (6) emergency public works, and (7) surplus commodities distributed for relief.

The timing of expenditure reporting constituted another of the central problems of the study. The need for simultaneous reporting of Federal, State and local expenditures on a comparable basis eliminated at the outset the possibility of obtaining in addition comparability as between programs in the timing of reporting. In the case of each program an effort was made to secure reports timed as nearly as possible in accordance with the date assistance or employment was extended to individuals whom the program was designed to aid. The timing of reporting was varied intentionally as between programs to cor-

respond to the circumstances affecting each program, the nature of the routine statistical procedures in use by each agency, and the availability of comparable data over the five-year time span. The compromises necessitated by these circumstances resulted in the following varied selection of dates chosen for the reporting of expenditures: the date the obligation was incurred by the Federal Government, the date of the Federal grant to a State for a given purpose, the date the obligation was incurred by a State or local government from Federal funds, the date of the completion of the Federal prepayment audit of vouchers, the date of the issuance of the check, the date of the withdrawal of cash from the agency's account for the payment of the check, the date of the completion of a given amount of construction as estimated on the basis of pay rolls issued and materials in place, and miscellaneous additional types. This heterogeneous mixture is admittedly very unorthodox from the point of view of standard accounting procedures. The final totals, therefore, cannot be regarded in any sense as an exact accounting record.

Other difficult problems centered around the necessity for avoiding duplication in the combined statement resulting from the reporting of the same expenditures by two or more agencies. Because of the numerous transfers of funds and the close interrelationships between agencies in the administration of some programs, overlapping between the reports of two or more agencies was surprisingly frequent. As a precaution against the possibility of adding in the same expenditures twice in the combined totals, agencies were requested to incorporate in their reports a number of details on expenditures in relation to appropriation acts. A careful comparative analysis of these reports in relation to comparable totals in published Treasury sources was in some cases necessary to locate and determine the nature and extent of overlapping between reports received. After the type of adjustment which was needed had been clarified, the necessary deductions were arranged in consultation with the agencies concerned. By this method all known duplication was eliminated from the final composite totals. This phenomenon of duplicate reporting, of course, would have been eliminated automatically had Treasury reports on checks issued been used in all cases as a basis for the Federal component of the tabulation.

Another type of difficulty involved the need for securing consistency as to the items included in, or deducted from, total costs. Difficulty in securing reports of administrative items of the type desired was particularly frequent. Lack of comparability also resulted from differences in the treatment of repayments on loans, refunds, proceeds from sales, and other miscellaneous receipts. Since receipts of these types usually

revert to general Treasury funds rather than to the accounts of particular agencies, agency accounts are not in general adjusted to provide for deductions of these types. Reports of land purchases and miscellaneous special programs were also difficult to secure on the basis required by the plan for the table as a whole. In so far as practicable, revised reports were secured to adjust for known and significant deviations from the general plan.

With the exception of these issues, the major tasks involved the interpretation of the purpose of the compilation to the agencies, the development in cooperation with them of plans for specifications satisfactory, in so far as possible, both to the agency and to the Committee staff, and the arranging of the necessary revisions in statements in order to meet more precisely the plan for the tabulation as a whole.

Other lesser complications arose in tracing down minor programs not included in previous tabulations, such as the costs of wheat and cotton purchased with Federal funds and donated to the Red Cross for relief distribution in 1932 and 1933, the costs of surplus commodities distributed for relief, and expenditures for direct relief made by the Office of Indian Affairs from regular funds. At the present time all these programs are of very minor magnitude from the point of view of expenditures, but their inclusion was considered essential to a complete picture and to the accurate portrayal of trends.

It should be emphasized that the result of so many compromises and adjustments to the inadequacies of existing data must of necessity be regarded as an approximation rather than as an exact financial record. The data, nevertheless, are believed to be sufficiently accurate to portray the general trends and the relative magnitudes of component programs.

Moreover, trends in expenditures by themselves have a limited usefulness. They can never be used to indicate either trends in the volume of need or trends in the extent to which need has been met. Trends in expenditures must be studied in relation to trends in case loads, trends in the amounts reaching persons in need, trends in governmental fiscal policies, and trends in related economic and social phenomena if they are to have definitive meaning for social policy. A thorough analysis of these expenditure trends in terms of this larger context is yet to be made.

HOUSEHOLDS AND PERSONS RECEIVING RELIEF OR ASSISTANCE

BY T. J. WOOFER, JR. AND T. E. WHITING

Works Progress Administration

THE TASK of estimating the number of different recipients of public relief and emergency employment in the United States is beset with many difficulties. Needy persons have been assisted through several programs designed to meet different aspects of the relief problem. Some of these programs have been operated by the Federal Government, some by the states with Federal assistance, and some by the states or their political subdivisions without Federal help. Basic data about recipients are available for most programs, but definitions of the units that are counted differ considerably. More serious problems in the preparation of consolidated totals are the selection of the agencies and activities to be included and the elimination of duplication which arises because families or single individuals often receive assistance from more than one program during the same month.

Nevertheless the need for estimates has been so urgent that the problem has received a considerable amount of attention from the Division of Social Research and the Division of Research, Statistics, and Records of the Works Progress Administration, and from the Division of Public Assistance Research of the Social Security Board. The estimates presented in the accompanying tables and charts were prepared jointly by the two divisions of the WPA in cooperation with the Social Security Board which provided much of the information concerning recipients of aid to the aged, aid to the blind and aid to dependent children, and assisted in the determination of estimates of duplication between these special types of assistance and other forms of public aid.

It is apparent that the best that can be expected at present is estimates of national totals which may be considered a first approximation of the desired result. However, the estimates presented below are believed to be sufficiently reliable to indicate approximately both trends and total volume of the load.

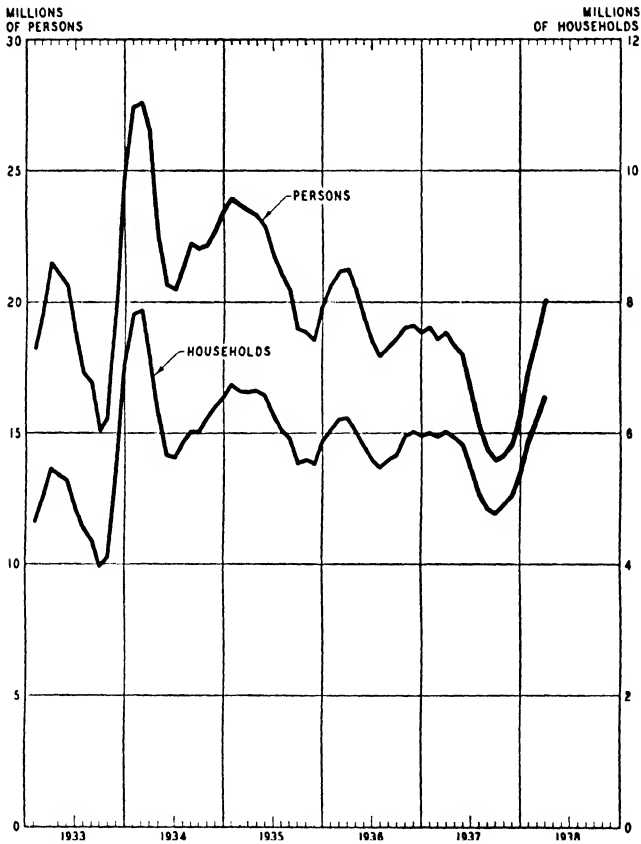
CHANGES REVEALED BY THE ESTIMATES

Both of the estimated series shown in Chart I and Table I reflect pronounced seasonal patterns with winter peaks. The series reached their high points for the entire period during the first quarter of 1934 when the Civil Works Program was in operation. In February of that year the estimated net number of persons was equivalent to more than

a fifth of the entire population of the United States. Partly as a result of the 1934 drought, the number of recipients was relatively large during the latter part of that year and the early months of 1935.

The downward movement which gathered momentum during 1935 was much more pronounced when measured in terms of persons than

CHART I
ESTIMATED NET TOTAL NUMBER OF HOUSEHOLDS AND PERSONS
RECEIVING RELIEF, WORKS PROGRAM EMPLOYMENT,
AND EMERGENCY EMPLOYMENT



when measured in terms of households. The decline from the high point in 1934 to the low point in 1937 is estimated to be 40 per cent in the number of households as compared with a 49 per cent decline in number of persons. The decline in the average number of persons per household, which has been evident since the beginning of the FERA

period may be attributable in part to the separation of two-family households and in part to the increase in the relative number of single persons which accompanied the specialization of assistance programs. It appears that family groups, and especially large families, have been more successful in obtaining adequate earnings from private employment than have single individuals. This might be expected since family groups often contain more than one employable member.

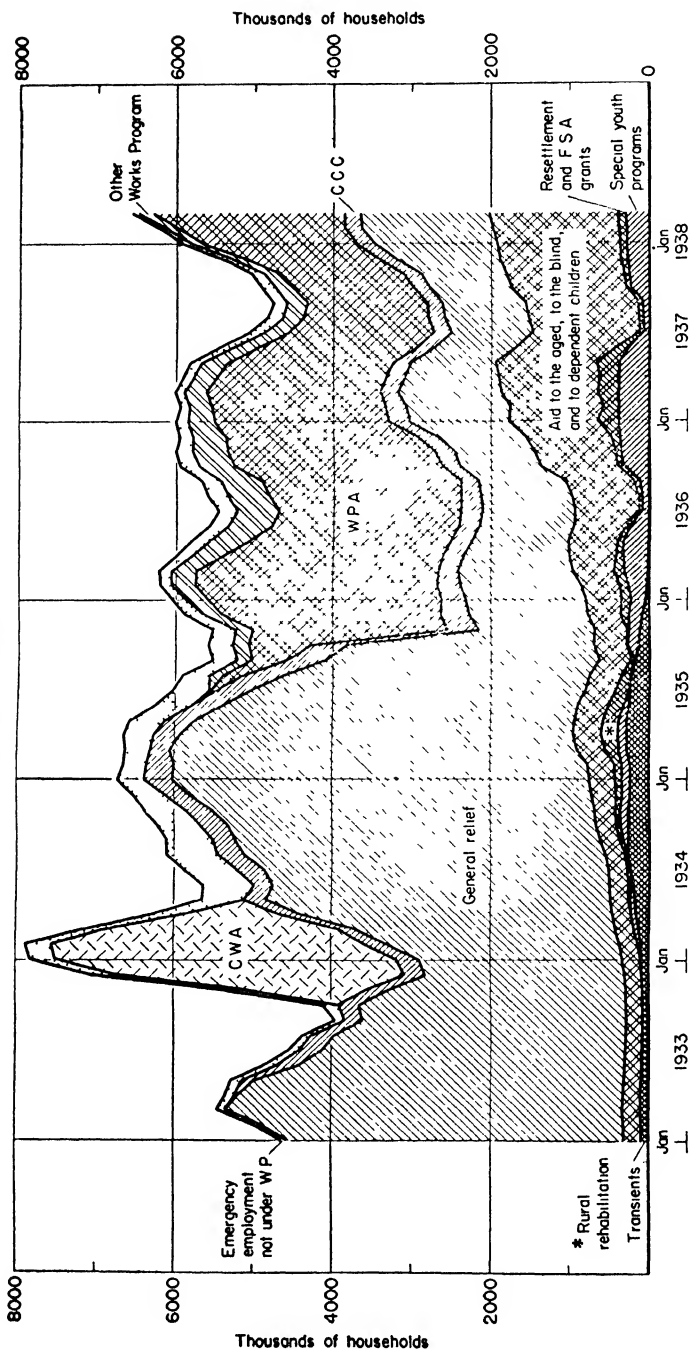
The charts indicate that in September 1937 fewer persons were aided than in any other month covered by the series. During this month the estimated number of persons represented approximately 11 per cent of the population of the Continental United States estimated for 1937. After this date, the number of households and persons increased sharply as a result of the recession in economic activity.

Because of the complexity of duplication between programs it is difficult to represent shifts from one program to another accurately in a simple chart. The distribution by agency in Chart II of the net total number of households was determined by arbitrarily allocating all duplicated households to the Works Program, the CCC, and the public assistance programs of the Social Security Board. The figures for WPA and the Works Program represent gross totals including duplication with all other types of assistance. The numbers shown for the public assistance programs of the Social Security Board exclude duplication between these three categories themselves and duplication with Works Program and CCC employment. For CCC employment the figures represent the total number of households with the exception of those which also received Works Program employment. The figures for Civil Works Program include duplication with general relief. In all other instances the figures do not include households which received more than one type of aid.

In general, the data plotted for each program contain duplications between this program and all other programs shown below it. This holds for all programs shown except that of general relief which contains households receiving general relief only. Thus, the chart suggests the major shifts between programs but it does not indicate with precision the relationship between an individual program and the net total.

The rapid rise and decline of employment under the Civil Works Program is evident from this chart. Persons aided under the special transient, emergency education and student aid programs while the FERA was in operation were largely absorbed by the programs of the Works Progress Administration and the National Youth Administration during 1935. The rural rehabilitation program initiated by the FERA in 1934 was transferred to the Resettlement Administration in

CHART II
ESTIMATED NET NUMBER OF HOUSEHOLDS RECEIVING RELIEF AND EMERGENCY EMPLOYMENT
January 1933-March 1938



See accompanying text for method of allocating duplicated households

TABLE I
ESTIMATED NET TOTAL NUMBER OF RELIEF AND NON-RELIEF HOUSEHOLDS
AND PERSONS THAT RECEIVED RELIEF, WORK PROGRAM EMPLOYMENT
AND EMERGENCY EMPLOYMENT

Preliminary figures, Continental United States, January 1933 to March 1938
(000 omitted)

Month	Households	Persons	Month	Households	Persons
1933			1936		
January	4,647	18,224	January	6,044	20,633
February	4,968	19,510	February	6,209	21,192
March	5,463	21,479	March	6,229	21,243
April	5,349	21,046	April	6,018	20,450
May	5,275	20,653	May	5,809	19,414
June	4,851	18,839	June	5,587	18,517
July	4,551	17,286	July	5,477	17,900
August	4,372	16,895	August	5,602	18,286
September	3,973	15,071	September	5,670	18,615
October	4,116	15,596	October	5,958	19,048
November	5,403	19,787	November	6,005	19,113
December	7,062	24,802	December	5,968	18,872
1934			1937		
January	7,821	27,449	January	6,000	19,050
February	7,879	27,606	February	5,954	18,614
March	7,169	26,495	March	6,015	18,846
April	6,270	22,448	April	5,929	18,373
May	5,658	20,648	May	5,744	17,541
June	5,631	20,475	June	5,473	16,783
July	5,872	21,352	July	5,069	15,266
August	6,106	22,244	August	4,849	14,380
September	6,111	22,065	September	4,764	13,987
October	6,220	22,204	October	4,907	14,135
November	6,391	22,758	November	5,041	14,597
December	6,547	23,475	December	5,390	15,603
1935			1938		
January	6,727	23,964	January	5,904	17,314
February	6,651	23,716	February	6,231	18,502
March	6,630	23,492	March	6,544	20,112
April	6,650	23,357	—	—	—
May	6,575	22,934	—	—	—
June	6,258	21,769	—	—	—
July	6,033	21,042	—	—	—
August	5,916	20,461	—	—	—
September	5,539	18,998	—	—	—
October	5,588	18,879	—	—	—
November	5,528	18,604	—	—	—
December	5,886	19,851	—	—	—

1935, which subsequently was succeeded by the Farm Security Administration.

The development of the Works Program beginning with the Summer of 1935, and of the public assistance programs of the Social Security Board in 1936 resulted in extensive transfers of general relief cases. While some of the increase in the programs of the Social Security Board resulted from such transfers, it is believed that a considerable portion of the persons benefited had not previously received general relief.

The distribution of the component statistics and the net totals after duplications are eliminated are shown for March 1938 in Table II.

COVERAGE

The agencies included in the series and the source of basic recipient data are shown in the stub of Table III. The principal problem arising

TABLE II

ESTIMATED NET NUMBER OF RELIEF AND NON-RELIEF HOUSEHOLDS AND
PERSONS THAT RECEIVED RELIEF, WORK PROGRAM EMPLOYMENT AND
EMERGENCY EMPLOYMENT DURING MARCH 1938

Preliminary figures, by programs, Continental United States
(000 omitted)

<i>Agency or Program</i>	<i>Households</i>	<i>Persons</i>
General Relief	2,000	6,400
Civil Works Program	—	—
Works Progress Administration	2,442	9,666
Civilian Conservation Corps	297	1,148
Aid to the Aged, Blind and Dependent Children	1,785	2,972
Transient Relief	—	—
Rural Rehabilitation Advances (FERA)	—	—
Farm Security Administration Grants	126	630
Student Aid	323	323
National Youth Administration Work Projects	153	165
<i>Net Total Relief Programs*</i>	6,307	19,305
Other Works Program	201	729
<i>Net Total Relief and Works Program*</i>	6,478	19,914
Emergency Employment of Other Federal Agencies	66	198
<i>Net Grand Total*</i>	6,544	20,112

* Does not equal the sum of the totals shown for individual agencies and programs because allowance has been made for duplication

in connection with the selection of agencies resolves itself into the question of whether or not to include only those agencies which required as a prerequisite for employment that need for relief be demonstrated. Agencies such as CCC, PWA and the Bureau of Public Roads did not require certification of need for relief until they were incorporated in the Works Program in 1935 and CWA never required it. In order to obtain a maximum of comparability relief and non-relief employees of all agencies providing emergency employment have been included.

It will be noted that the arrangement of activities in Table II permits the exclusion of both "Emergency Employment" and Works Program activities conducted by Federal agencies other than those included in the first sub-total. The item "Emergency Employment" shown in Table II covers that provided with Reconstruction Finance Corporation funds and employment of the Bureau of Public Roads and Public Works Administration financed from all funds other than those appropriated by the Emergency Relief Appropriation Acts. Employment provided under the Emergency Relief Appropriation Acts which is usually designated as "Works Program" employment has been included in the preceding subtotals.

The monthly figures for the number of recipients aided by each agency do not include administrative employees but insofar as feasible they do include all recipients of relief, works program and emergency employment wages. Except during the CWA period, a large number

TABLE III
SOURCE OF DATA ON NUMBER OF RECIPIENTS AND EXTENT OF DUPLICATION

Agency or program (1)	Source of recipient data (2)	Types of duplication				
		General relief (3)	Civil Works Program (4)	WPA and other Works Program agencies (5)	CCC (6)	Aid to the aged, to the blind, and to dependent children (7)
General relief	FERA official reports until March 1937 Subsequent months from Social Security Board reports		(a)	(a)	(b)	(a, b, c)
Civil Works Program	Official CWA reports The figure used is the maximum weekly employment	(a)		(d)	None	None
Works Progress Administration	Official reports of WPA, the figure used is the maximum weekly employment	(a)	(d)		(b)	(b)
Other Works Program agencies	Official reports of WPA, the figure used is the maximum weekly employment	(a)	(d)	None	(b)	(b)
Civilian Conservation Corps	Estimated monthly average derived from official reports of the CCC	(b)	None	(b)		(b)
Transients	Estimates prepared in part by WPA, Division of Social Research and in part WPA Division of Research, Statistics, and Records	(a, b)	None	(a, b)	None	None
Aid to the aged, to the blind, and to dependent children	Estimates for 1933 through 1935 by WPA Division of Social Research, 1936-1938, from Social Security Board reports	(a, b, c)	None	(b)	(b)	
Resettlement and Farm Security Administration grants	Resettlement and Farm Security Administration official monthly reports	(b)	(d)	(b)	(b)	(b)
Special youth programs	FERA Student Aid—official monthly reports of FERA NYA Student Aid and Work Projects, official monthly reports to WPA	(a)	None	(a, b)	None	None
Rural Rehabilitation	FERA official monthly reports until July 1935. Subsequent months estimated by WPA, Division of Research, Statistics, and Records	(a)	(d)	None	None	None
Emergency employment of Federal Agencies other than under the Works Program	Reports of the Bureau of Labor Statistics and the Bureau of Public Roads	None	None	None	None	None

(a) WPA, Division of Research, Statistics, and Records.

(c) Social Security Board, Division of Public Assistance Research.

(b) WPA, Division of Social Research.

(d) Not operating concurrently.

of the non-relief persons allowed for in the estimates were skilled and supervisory employees necessary to the operation of the works programs. It is probable that many of the non-relief persons included in the tabulation were either at or near relief levels. It is certain that their employment on public projects resulted in their temporary removal from the labor market.

Some activities have not been included because no comprehensive statistics are available. Such activities include veterans' aid, cases receiving hospitalization only, burials and institutional cases such as inmates of poor-farms which have been excluded by definition from reports submitted to Washington. It is believed, however, that they are not of sufficient relative importance to alter the totals appreciably. Persons who received surplus commodities only are excluded for the same reason. A special survey made by the Works Progress Administration indicated that approximately 250,000 families received only this type of aid during December 1936. The estimates also exclude recipients of unemployment compensation.

Relief given by private agencies is also excluded. Rough estimates prepared by the WPA indicate that this type of assistance reached a peak of around 600,000 households early in 1933 after which it declined to an average of about 100,000 to 150,000 households in 1935, 1936 and 1937. These estimates, which in their present form are tentative, are not included. It is believed that a relatively large proportion of private relief cases also received public aid. But even the gross totals are small in comparison with the totals for public relief recipients.

ESTIMATING THE NUMBER OF HOUSEHOLDS AND PERSONS

Most of the major agencies have maintained continuous records of the numbers of recipients benefiting from their activities. As might be expected, these records were usually designed to meet the current administrative needs of the operating agencies, with the result that wide differences exist in the characteristics of data available for the various programs. For example, figures for the Civil Works Program represent the number of different persons employed at any time during the week while those for the aid to dependent children program of the Social Security Board represent the number of different families and the number of different children aided at any time during a month.

The estimates have been expressed in terms of both the number of households and the number of persons, or individual members of households, who were aided at any time during a calendar month.

These units are essentially the same as the case and person units used in reporting general relief activities which from 1933 through 1935 were financed largely with funds granted by the FERA. For a number

of other programs it was necessary to select from the various available figures a series which most closely approximated these common denominators. For example, the number employed during the peak week of each month was utilized for the Civil Works Program and for employment provided by the WPA and other Federal agencies participating in the Works Program. It is recognized that this procedure results in a slight understatement since some individuals who were not employed during the peak week of a month may have worked during other weeks of the same month. It does not seem desirable, however, to make a statistical adjustment for this factor.

More than one member of a household may be enrolled in CCC camps. On the basis of surveys conducted by the WPA, a special series representing the number of different households of which CCC employees were members was prepared. Through the cooperation of the Social Security Board a similar adjustment was made for recipients of old age assistance, since some of the individuals reported as receiving this form of aid are members of the same household. In the case of aid to dependent children, data on the number of families in which children were aided were used as representing households. Studies of data pertaining to other programs indicate that adjustments of this type are not necessary.

Estimates of the number of persons are considered to be of importance because they can be related to the total population of the country and because they reflect changes in the size of households which receive public aid. The number of individual persons benefiting was reported monthly for the general relief program. For most activities, however, it was necessary to prepare estimates, on the basis of FERA experience. For example, it was assumed that the average number of persons represented by households that received subsistence grants made by the Resettlement and Farm Security Administrations was the same as the number reported for the rural rehabilitation program of the FERA. During each month that the program was operated by the FERA the average family aided contained 5 persons. It was also possible to determine the number of persons represented by employees of the emergency work relief program conducted by the FERA and it was assumed that these ratios were typical of CWA, WPA and other Works Program employment. In a number of instances it was possible to verify estimates of the number of persons per household by comparison with tabulations covering sample rural and urban areas.

DUPLICATION

Each time that a new program was established or an old program expanded or contracted many persons who were transferred received

one type of assistance during the first part of a month and another type during the latter part of the same month. Each agency reported them as receiving aid during the month. Duplication of this type was especially large during the period when the Works Program was expanding rapidly since it was common practice to continue general relief to persons assigned to work program projects until they actually received a check which was sufficiently large to meet their current needs. A second type of duplication exists when families who are unable to obtain adequate assistance from one agency receive supplemental aid from another concurrently. For example, a family which has a son in a CCC camp may also receive general relief or some other type of assistance. The types of duplication eliminated are shown in Table III. A detailed description of each method would prove too long for this article.

Duplication between general relief and Works Program employment was estimated in part from monthly reports prepared by various states which were requested to furnish this information. While for most months these reports have covered a large portion of the total duplication, it has been necessary to supplement this information with data pertaining to the turnover of Works Program employment. A more detailed discussion of the method of eliminating this and other forms of duplication may be found in the *Monthly Report of the FERA* for June 1936.¹ Information concerning duplication between various types of public assistance programs for aid to the aged, the blind, and dependent children was calculated for 1933, 1934, and 1935 from studies made in the Division of Social Research—one conducted in 13 cities furnishing an urban factor and one in 67 rural counties a rural factor. Later factors were estimated by the Division of Public Assistance Research of the Social Security Board on the basis of state reports showing the amount of duplication. In eliminating this duplication the first step was to estimate the intercategory duplication between the aged and other categories, the blind and other, and the dependent children and other. Then, duplication between the categories and other agencies was estimated.

Allowance was also made for duplication in the data reported for the Civil Works Program, CCC, transient relief, student aid, and NYA work projects, through the use of information obtained from special tabulations prepared by the WPA.

¹ See Emerson Ross and T. E. Whiting, "Changes in the Number of Relief Recipients," *Monthly Report of the FERA*, June 1936, pp. 1-21. Although the estimated totals presented in this report are more limited in scope than those presented on the accompanying pages, essentially the same processes were used to eliminate duplication between general relief cases and persons employed under the Civil Works Program and the Works Program.

RESIDUAL RELATIONSHIPS AND VELOCITY OF CHANGE AS PITFALLS IN THE FIELD OF STATISTICAL FORECASTING*

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THE term residual relationship is intended to cover those cases where, in a statistical classification, the item upon which attention is focused represents a relatively small amount left over after some other item is subtracted from the total. In many instances, though not always, the residual items represent concepts which are negative in character. Typical negative residual concepts are illiteracy, inability to speak English, and unemployment; a residual concept which is not negative is that of the number of migrants obtained by computing the survivors from one census in a given area and comparing them with the actual count at the next census.

Illiteracy. Let us consider further the first example mentioned. An illiterate person is defined as one who is not able to read and write. The whole number of illiterates is therefore what remains after the number of persons returned as being able to read and write is subtracted from the total population—both counts being limited in census practice to persons 10 years old and over. A typical percentage of *literacy*, that is, of persons 10 years old and over who *are* able to read and write, is about 98.8; this leaves 1.2 as the percentage of illiteracy, or 12 illiterate persons in each 1,000 of the population. Obviously, if 6 more persons in each 1,000 should learn to read and write, the effect on the percentage of literacy would be slight, simply bringing it a bit closer to the 100 per cent which it already approximates. But the subtraction of 6 persons from the illiterate group reduces that percentage by one-half, or from 1.2 to 0.6.

Again, suppose that in preparing the census schedules for tabulation it were discovered that for an occasional person there was no answer to the question as to whether able to read and write; and suppose, further, that it were proposed to count these blanks, or failures to reply, as negative answers. (One might question the wisdom of such a procedure, but there would be in its favor at least the argument that a person who did not know how to read and write would be much more likely to decline or neglect to answer this question than one who did.) Let us assume that for the first 1,000 persons reported in a given area the answers to the literacy question comprise 975 Yes's, 12 No's, and

* A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 29, 1937.

13 blanks. If we include the blanks with the Yes's, giving these cases the benefit of the doubt, we get 1.2 per cent illiterate; if we omit them altogether and compute the percentage on the basis of the 987 definite answers returned, we still get 1.2 per cent; but if we count the blanks as No's, we get 2.5 per cent illiterate, or more than twice as much as by the other methods. Evidently, the method of handling the blanks in this tabulation has a tremendous bearing on the percentage of illiteracy. On the other hand, it makes very little difference in the percentage of *literacy* whether the blanks are included or not. The fundamental reason for this is that the number of blanks is a function of the entire number of units canvassed, and where the residual is very small, as in the case of illiteracy, the number of blanks tends to be overwhelmingly large in relation to the residual.

In actual census procedure the blanks in the returns for literacy, which are not very numerous, are included with the Yes's; and since in the general tables there is no publication of the number or percentage of persons who are literate, the blanks disappear from the picture altogether. But it would be possible to find many cases in actual statistical practice where the method of disposing of blanks or doubtful cases is exactly parallel with the hypothetical process of counting the blanks with the No's which has just been outlined.

Unemployment. The concept of unemployment is now in process of radical change, as a result of recent and current economic conditions, especially of the rise of a large group of first-job-seekers, or persons who have never worked for pay; and one would hesitate to offer a definition that would be currently satisfactory. But under conditions as they existed in 1930 the concept was fairly clear-cut. The typical unemployed person then was a person who had had a job, had lost it, and was trying to get another job. The unemployed thus formed a residual class comprising what was left of the whole number of gainful workers after those still at work were taken out. This concept formed the basis of the unemployment censuses of 1930 and 1931.

The relations already illustrated for the concept of illiteracy hold good for the concept of unemployment under such a definition. With nearly 50,000,000 gainful workers, that is, persons who usually work, and only 2,500,000, or 5 per cent, out of a job, it is evident that a 6 per cent decrease in employment would more than double the number and percentage of unemployed; or, conversely, that a 6 per cent increase in employment would wipe out the unemployment altogether.

When the tentative plans for the 1930 census of unemployment were under discussion in 1928 and 1929, one of the reasons advanced to justify the taking of such a census was that the resulting figures would

be useful, not only as indicating the extent of unemployment in 1930, but as a starting point for a series of annual estimates of unemployment. In those early days, however, no one realized what a serious pitfall for prospective estimators might be found in the residual nature of the unemployment concept, if the attempt were made to use it in combination with the current indexes of employment. Failure to recognize this danger led to a serious error in connection with the initiation of one of the now currently accepted series of unemployment estimates.

As a starting point for the series of estimates just referred to, the census unemployment classes were regrouped for the purpose in hand in a manner quite reasonable and satisfactory; and the basic assumption (also probably justified) was made that the unemployment census in the 19 cities in 1931 was possibly more reliable, so far as it went, than the country-wide enumeration in 1930. At this point, however, the marginal nature of the unemployment data began to make trouble. The next step was to compute the percentage of *employment* on the basis of the difference between the number of gainful workers in 1930 and the number returned as unemployed in the 19 cities covered by the 1931 census, for both 1930 and 1931. These cities were considered as representative of the whole country, in spite of the fact that they contained only about one-sixth of the entire population, with no representation for rural areas.

Next, the relation between these two percentages of employment, the one for 1930 and the one for 1931, was compared with a composite index of employment based on sample returns from a list of principal industries which omitted entirely industries employing more than 40 per cent of all gainful workers.

The computations based on census figures indicated that 1930 employment was 116.49 per cent of 1931 employment, while the composite index, based on limited sample returns from an incomplete list of industries, showed 1930 employment to be 114.75 per cent of 1931. The difference was thus less than 2 per cent, and one would think that the obvious conclusion from this comparison would have been that, testing the employment index against the showing of the census, the index had done very well indeed to come so close; and that if anything were to be "corrected," it should be the index.

But not so. The maker of unemployment estimates, in order to close up this gap of less than 2 per cent between the census ratio and the index, proceeded to add a cool million, or nearly 30 per cent, to the unemployed laboriously counted in the 1930 census.

There are other elements subject to criticism in the process under consideration besides the one which rests on the failure to recognize

the residual nature of the unemployment concept, but this one seems to occupy the center of the picture.

Migration. The process of estimating the migration into or out of a given area between one census and another by computing survivors from the first census to the date of the second, is another example of residual relationship, subject to almost as many possibilities of misleading results as those involving narrow margins of a negative character.

The process and some of its dangers may be illustrated as follows: Suppose that Blank County had a population of 20,000 in 1920, and that the number of survivors from 1920 to 1930, computed on the basis of standard expectations, was 18,000. Suppose further that the 1930 census returns showed 18,300 persons 10 years old and over. This would seem to indicate a net migration of 300 such persons into the county during the decade. But suppose a question is raised as to the applicability of the standard expectation of life to Blank County, and that it is finally shown that the death rates in this county are appreciably higher (or lower) than those on which the standard tables are based, and the survival rates, therefore, correspondingly lower (or higher). An error of only 2 per cent in the computation of survivors will either wipe out entirely the assumed migration in, or more than double it.

Velocity of change. In putting together in my title the ideas of marginal relationships and velocity of change, it may be that I have tried to join two concepts which may have little in common except that they are both sources of difficulty in statistical forecasting. And I may be adopting an unduly pretentious terminology for sources of difficulty already too familiar. But let me try to make clear by an illustration what I mean by velocity of change.

Twenty years ago there were half a dozen roads leading northward from the city of Washington on which, shortly after crossing the District line, one found oneself in the open country with fields and areas of forest land along the way. Fifteen years ago the general situation was still the same; and ten years ago; and five years ago. Through all this period new houses were being built along these roadways; one house here this year, another house there the following year, and so on, with ample time for the lover of empty, unbuilt-up country to get used to the gradual encroachments.

But since about 1934 things have been different. On some of these roads new houses are springing up all along the way for 5, or 10, or even 15 miles out. And it is no longer a single house here and there;

there are groups of houses, rows of houses, and whole blocks of little houses set close together in the midst of wooded areas which ought to have been reserved for two or three homes with ample space around them.

In one sense this recent movement is not a new one, since the country has been gradually building up all along; but in the past two or three years the process has been so much speeded up that one does not recognize it. More new houses have been built in six recent months than in the whole 20 years ending in 1934. This is the sort of thing that may take place in any of the fields wherein statisticians try to forecast the future.

There are frequent demands, not only for estimates of the current population of cities (which can eventually be supplied on the basis of current local data collected and standardized), but also for long-time forecasts of what the population will be 20, 30, or 40 years into the future.

There still remains a tendency to base forecasts of the future on past rates of increase, though where these rates have been high, the very absurdity of the resulting forecast has brought with it some degree of caution. If the city of Dearborn, Michigan, for example, should increase in population at the same rate in the next three decades that it did between 1920 and 1930, it would have, in 1960, a population of more than 400,000,000, or about three times our best estimate for the United States as a whole.

The standard method of making official estimates of population for intercensal years up to 1926 was the so-called arithmetic projection method, which assumed that the numerical increase in the population of a place or of a State in each year subsequent to the latest census was the same as the average per year for the last completed census decade. In other words, it assumed that the population increase continued at practically the same rate as before. (The arithmetical additions amount to slightly less than geometric additions—that is, additions of the same percentage each year as the average percentage for the last completed decade; but except for cases of very rapid increase, the difference is negligible.)

In 1926 a new method of estimating the national population was adopted, based on births, deaths, and net immigration. With restricted immigration and declining birth rates, the annual increments, especially after 1930, were much smaller than the average for the preceding decade; and the projected increases for States and cities were scaled down in proportion. This was a partial recognition of a modi-

fication in the velocity of change; but it still left the changes traveling in the same direction, with a rapid increase allotted to that State or city which had had a rapid increase, or vice versa.

On the basis of general information, supported by fragmentary statistics, we felt certain that there had been a general movement of population out of many industrial cities into rural areas between 1930 and 1933, or at least a general cessation of the usual cityward movement, which since 1933 may safely be assumed to be again in operation. After 1933, because of this situation, we stopped making estimates for cities on the basis of past performance.

The falsity of the assumption of continued movement in the same direction, even, let alone at the same velocity or even at the same velocity modified by a uniform reduction factor, is sufficiently demonstrated by the cases of two large cities which have had censuses since 1930. The 1933 estimate for Chicago was 3,490,700, and that for 1934 carried forward by the same method would have been 3,528,705, representing an increase over 1930 of 152,267. An actual census of Chicago taken in 1934, however, showed only 3,258,528, representing a decrease of 117,910 since 1930. The case of Detroit is even more striking, since that city had both a very rapid increase from 1920 to 1930 (thus establishing a high velocity of increase) and a very severe reaction to depression conditions. The 1935 estimate for Detroit would have been 1,728,577, representing an increase of 159,915, while an actual census taken in 1935, after at least a year of rapid recovery, showed only 1,469,066, or 99,596 less than in 1930.

Evidently the possibilities for sudden changes, for reversal of trends, and for growth in new directions—or for a cessation of growth in the old directions—which have come with the speeding up of mechanical processes and commercial activities, have made it no longer safe to base forecasts directly and solely on past records; have made even the most carefully constructed “normal curve” of little more service than a medieval suit of armor in front of a Japanese machine gun.

For the larger areas, to be sure, especially for the United States as a whole, one may still base computations of probable future performance on what has been done in the past—with rather extensive allowances for a slowing down in one factor and an inevitable speeding up in another. This is possible partly by reason of the greater stability of large quantities under any process of change; but more because the factors which produce such radical differences in the rate of change in cities and even States are *internal* factors, taking away from one area (or many areas) what might have come to it (or them) and di-

verting the current towards another area, but all within the boundaries of the country as a whole.

The way out of the difficulty seems to be, therefore, to devote more study to the underlying factors which tend to divert population (or trade, or manufacturing production, or anything else) from one area to another, and thus to speed up or retard the velocity of change in the elements for which the forecast is required. And since the factors thus to be studied are numerous and closely interrelated, both among themselves and in the different areas in which they operate, it would seem that large-scale, coordinated study would have more promise of success than that which could well be undertaken in the interests of one organization in one area alone.

THE RELIABILITY OF PRELIMINARY PRICE INDEXES

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A CONSIDERABLE number of price reporting agencies are currently computing price indexes using the type of construction generally known as the "Fisher ideal formula," expressed in symbols by the formula

$$\sqrt{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}}$$

where p_1 and p_0 are the prices of the commodities in the current and base periods, respectively; q_1 and q_0 are the quantity weights of the commodities in the current and base periods, respectively. This is, of course, a geometric mean of two ratios, one of which is a ratio of the aggregate value of a bill of goods sold in a base period and priced at current prices, to a similar aggregate value of the same bill of goods priced at base period prices. The second ratio is that of the aggregate value of a similar bill of goods sold in the current period and priced at current prices to the aggregate value of the same bill of goods priced at base period prices. Obviously if the quantities of identical items sold were the same in the current and base periods the ratios would be identical and there would be no point in taking a mean of identities. But there are usually discrepancies between these quantities, and when these become substantial there is raised against the use of either ratio alone as a price level indicator, the objection that neither of them is adequate, that each omits a part of the truth.

It was in part to meet this objection that the "ideal formula" has been rather widely used, since this type is a "cross" between two ratios which are subject to opposite errors. But the question frequently has been raised as to whether the closer approximation obtained by the use of this formula is worth the added labor involved; that is, in contrast to an index that is a ratio of aggregates, $\Sigma p_1 q_0 / \Sigma p_0 q_0$. The problem is essentially a matter of weights. When a large number of commodities enter into the aggregates it becomes a laborious task to assemble the current weights. For some of the items there may be a lack of reliable statistics from which to derive quantities, necessitating estimates by devious, if not highly questionable methods. Where reliable statistics are available they are frequently so slow in coming through the mill that they are not available for use until the time of

maximum usefulness of the index number is well into the past. As a test, therefore, of the value of the added labor involved in the "ideal formula" computation a comparison is made in this study of the "ideal formula" computations and the indexes arrived at by the single ratio of aggregates using only base quantities, $\Sigma p_1 q_0 / \Sigma p_0 q_0$.

The Minnesota Farm Price Index Number is an example of the use of the "ideal formula." The index includes sixteen items, which contribute about 95 per cent of the state's agricultural income. The crop items include: wheat, corn, oats, barley, rye, flax, potatoes, and hay. The livestock items are hogs, cattle, calves, and lambs-sheep. Butter-fat, milk, chickens and eggs constitute the list in the livestock products group. This index number has been computed back to 1910 and is published currently. The first half of the formula, $\Sigma p_1 q_0 / \Sigma p_0 q_0$, is published monthly under the caption "preliminary farm price index," and uses current prices and base period quantities. The tests were made to measure the accuracy of this simple ratio as a forecaster or indication of the final index computed by the "ideal formula." The period included in the study was 1910-1935 inclusive, with a total of 312 readings.

TABLE I
A COMPARISON OF ERRORS IN MINNESOTA MONTHLY FARM
PRICE INDEX NUMBER

Reading	Preliminary index	Final index	Difference points	Percentage difference
<i>High months</i>				
Feb., 1918	150 3	153.2	2.9	1 9
Mar., 1918	140 9	147 9	7 0	4 7
Apr., 1918	141 8	145 4	3 6	2 5
Aug., 1918	143 4	141 4	2 0	1 4
Dec., 1918	149 6	147 7	1 9	1 3
<i>Low months</i>				
Oct., 1932	36 5	37 9	1.4	3.7
Jan., 1933	34 6	36 2	1.6	4.4
Sept., 1933	60 5	57 5	3.0	5 2
Oct., 1933	52 0	50 0	2 0	4 0
Nov., 1933	50 3	48 5	1 8	3 7

A simple numerical difference between the preliminary and final indexes would of course give a rough notion of the amount of error in the preliminary index. But the limitations of such an analysis may be seen from Table I, where the preliminary and final readings for selected high and low months have been compared both as to the arithmetic error between the preliminary and final figures and the percentage the error is of the final index. An error of seven points in March 1918 was of relatively less importance than the 3 point difference for September, 1933. While this illustration magnifies such discrepancies (arising from different price levels) over the average situation, it was nevertheless decided to eliminate them entirely. Therefore the method chosen for

the tests was, as indicated in the percentage columns of the table, to express the preliminary indexes as a percentage relative of the final index, and to treat the deviation of this relative from 100 as the error of estimate.

Analyzed in this way, the errors for the period of 312 months averaged 1.2 per cent. The standard error of estimate of the preliminary index was 1.7 per cent for the period. Sixty-two per cent of the errors were less than 1 per cent. There could scarcely be made a reasonable complaint against a preliminary figure with an error of one per cent, or less. But it is in the remaining 38 per cent of the readings that the larger errors occur, ranging up to 8 per cent. The frequencies of such errors at given magnitudes are shown in Table III.

In order to locate the points of greatest variation in this index the indexes of the three groups composing the total, separately computed but using the same methods and identical data, were subjected to the same analysis as was given the index of the entire 16 commodities. Table II shows the results for the three groups and the total index.

TABLE II
COMPARISON OF ERRORS IN PRELIMINARY PRICE INDEXES FOR 3 GROUPS

Index	Average error, per cent	Standard error of estimate, per cent	Percentage of errors under 1 per cent
Crops	1 8	2 3	59
Livestock	0.9	1 4	71
Livestock products	0 5	1 2	91
Total, 16 commodities	1.2	1 7	62

The results set forth in this table clearly reveal differences in physical quantities of marketings (the weights for prices) with which every student of agricultural economics is familiar. The crops group index is subject to the widest errors because the marketings are varied considerably by drought and growing conditions in addition to year to year shifts or changes in production. Moreover, there has been, in Minnesota, during the period covered in this study, a considerable shift away from cash crops to feed crops. Livestock production is less subject to weather and crop-growing conditions, and accordingly shows less variation in marketings, resulting in smaller errors for the preliminary price index as indicated in Table II. The smallest errors occur in the livestock products index, which is heavily weighted with dairy products, the most stable of the three production groups. Variations in the seasonal rates of marketing of all the various commodities also

give rise to shifts in the current weights for the indexes. The frequencies of errors in these groups, by magnitude, are given in Table III.

TABLE III
FREQUENCIES OF ERRORS IN MINNESOTA PRELIMINARY FARM PRICE INDEXES

Percentage error of preliminary index	Total, 16 commodities	Crops	Livestock	Livestock products
0 0-0 4	108	48	154	235
0 5-0 9	87	76	67	48
1 0-1 4	36	48	33	16
1 5-1 9	26	41	21	5
2 0-2 4	22	22	13	0
2 5-2 9	9	18	5	2
3 0-3 4	4	20	5	0
3 5-3 9	3	14	3	0
4 0-4 9	10	10	8	1
5 0-5 9	4	10	1	1
6 0 & over	3	5	2	4
Total	312	312	312	312

The conclusions to be drawn from this examination, in their application to specific indexes, depend of course upon the types of quantities to be priced, and the ultimate uses to be made of the index. For an index of which it is important that there be prompt current calculation and publication, having not very great fluctuations of weights in the basic data, intended primarily or exclusively as a price index, this study would seem to justify the contention that the extra labor involved in the "ideal" formula method contributes, on the whole, very little to the value of the index. Some price indexes are subject to very minor error throughout the major part of their readings and hence offer a satisfactory figure when computed by the less laborious method of a single ratio of aggregates of values of base weights at current prices. But in the index number here studied the errors at certain times resulted in rather serious misstatement, serious enough to justify the added labor involved in using current weights.

One of the great advantages of the "ideal" index formula is the "factor reversal" aspect. If an index is to have other uses than simply to show current price levels, such uses preclude calculation by the simple ratio method alone. By a rearrangement of factors the Minnesota Index is used to show indexes of value of marketings, that is $\Sigma p_1 q_1 / \Sigma p_0 q_0$, and of physical volume of sales,

$$\sqrt{\frac{\Sigma p_0 q_1}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_1 q_0}}$$

In all cases where there is prospect of using the indexes to show value and quantity changes in addition to price levels the factor reversal

possibility becomes a distinct advantage favoring the "ideal" formula and justifying the additional labor.

It is believed that this study affords a fair measure of the reliability of preliminary price indexes. It is taken from actual rather than hypothetical cases. It covers a period of extreme fluctuations in price level. The quantity weights are characterized by very pronounced shifts away from base period proportions. Finally, the month to month, seasonal rates of marketing have varied considerably. Thus there were present three factors tending to maximize the errors in the preliminary index.

VARIATIONS IN FAMILY LIVING EXPENDITURES*

BY DOROTHY S. BRADY
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U. S. Department of Agriculture

IN the analysis of expenditure data from the Study of Consumer Purchases¹ some attention has been given to the problem of measuring the dispersion of expenditures for the main groups of items in family living and the relationship of the dispersion to the principal categories of analysis which have been established for this study. In many communities the number of families in each income class is large enough to permit a study of the relation of the dispersion of expenditures not only to income but also to other factors affecting consumption, such as occupation and family composition. Accordingly, the standard deviations of the 15 principal groups of expenditures have been calculated for all classes of families in three groups of communities, comprising four small cities in Oregon and Washington, 24 villages on the Pacific Coast, and four farm counties in Pennsylvania and Ohio.

The relationships found between the distribution of family expenditures within classes and the factors of income, occupation, and family composition have a theoretical interest for students of family consumption. In addition they have a distinct practical value in providing a basis for estimating the standard deviations for a much larger part of the data.

Almost without exception the standard deviations of all expenditure groups tend to vary with the income class nearly in proportion to their means. Thus the coefficient of variation fluctuates around a constant value independent of the income class. When lines were fitted to the means and standard deviations of 15 expenditure groups for nine classes of families in the small city community and for seven classes of families in the farm community, the value of the constant term was found to be significantly different from zero in only a few cases. In these cases, of which an example is given in Figure 3, the coefficient of variation shows a tendency to decrease with higher values of the mean. These exceptions, however, are not associated with the same expenditure group in the three communities and therefore it is probably safe to disregard them. The scatter diagrams for the other expenditure

* A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 30, 1937.

¹ The Study of Consumer Purchases was conducted cooperatively by the Bureau of Home Economics of the United States Department of Agriculture and the Bureau of Labor Statistics of the United States Department of Labor with funds supplied by the Works Progress Administration. The National Resources Committee and the Central Statistical Board cooperated with the operating agencies in the formulation of plans and the development of technical procedures.

groups given in the chart illustrate how well a straight line through the origin fits the data. For all expenditure groups the points which deviate the most from the line represent classes in which the number of families reporting was small. Since this tendency for the coefficient of variation to approach a constant appears in the expenditure data for communities as different as the Northwest small cities and farms in Pennsylvania and Ohio, it seems reasonable to assume that the relationship holds in general for small city, village, and farm communities included in this study and to use the coefficients of variation for a few income classes as estimates for those of other income classes.

To test whether the coefficients of variation vary with occupation or with family type, the Method of Ranks developed by Mr. Milton

TABLE I
COEFFICIENTS OF VARIATION OF EXPENDITURES FOR CLOTHING AND MEDICAL CARE FAMILIES WITH ONE OR TWO CHILDREN UNDER 16, OREGON AND WASHINGTON SMALL CITIES, 1935-1936

Income class	Clothing			Medical care		
	Wage earner	Clerical	Business and professional	Wage earner	Clerical	Business and professional
\$ 750-\$1000	45	55	50	111	93	66
1000- 1250	42	39	35	93	106	134
1250- 1500	38	41	48	93	80	68
1500- 1750	47	28	35	106	80	92
1750- 2000	44	43	46	85	108	58
2000- 2250	44	38	48	122	80	93
2250- 2500	46	43	46	43	65	80
2500- 3000	42	47	49	94	146	92
3000- 3500	37	25	36	78	92	80
3500- 4000	—	—	45	—	—	156
4000- 5000	—	—	49	—	—	122

Friedman² was used. Only in the case of tobacco expenditures were significant differences found in the coefficients of variation for the three occupational groups, wage earner, clerical, and business and professional. Table I illustrates the similarity in the coefficients of variation for the three occupational groups for one of the less variable expenditures, clothing, and for medical care, the most variable of the large expenditure groups. This similarity among the occupational groups may be a consequence of the broad classification used or may reflect the fact that in smaller communities there is less tendency for families in different occupational groups to diverge in their consumption patterns.

When the relation of dispersion to family type was tested, differences were found in the coefficients of variation for a number of expenditure groups. These groups include food, clothing, household operation,

² "The Use of Ranks to Avoid the Assumption of Normality Implicit in the Analysis of Variance," this JOURNAL, 32 (1937) 675-701.

medical care, personal care, and gifts. Some of the family types defined for the purpose of classification are more homogeneous than others.³ It is in these types that the coefficients of variation have somewhat lower values. Table II, showing the coefficients of variation of clothing expenditures for six types of families, illustrates the magnitude of such differences. Slightly lower values tend to be associated with family types having one, two or three children under 16 years of age. There is a tendency throughout for the expenditure of families consisting of husband and wife to be more variable.

The coefficients of variation for families of different types are of the same relative magnitude for small city, village, and farm families except for the one class, housing expenditures. For farm families such

TABLE II
COEFFICIENTS OF VARIATION OF EXPENDITURES FOR CLOTHING
PENNSYLVANIA AND OHIO FARM FAMILIES, 1935-1936

Income class	Families of husband, wife, and—					
	No others	One person under 16	Two persons under 16	Three persons under 16	One person over 16 and 1 or no other person	One person over 16, one person under 16 and 1 or 2 other persons
\$ 250-\$ 500	111	83	47	—	71	—
500- 750	64	54	66	43	68	69
750- 1000	59	53	40	39	53	43
1000- 1250	49	61	41	36	46	45
1250- 1500	48	51	44	31	50	53
1500- 1750	60	55	45	47	43	56
1750- 2000	60	31	42	38	55	45
2000- 2500	58	48	50	34	54	37
2500- 3000	44	53	57	46	55	55

expenditures included only insurance, and repairs, while in the city and village, rent, interest on mortgage, and taxes were also included. The difference is thus a matter of non-comparable classifications. In general, the expenditures of farm group are more variable than are those of the corresponding city and village groups. Since money expenditures are dependent on money income, and since within any given income class farm families have a much higher proportion of non-money income than city or village families, the differences may be almost entirely ascribed to the greater variation in money income within the income class.

Averages and standard deviations were computed on the basis of all families in the class. In order to eliminate the effect of income for a selected number of expenditure groups, the expenditure of each family was expressed as a relative of the average for the income class. For

³ For a discussion of the classification by family type, see Day Monroe, "Analyzing Families by Composition Type with Respect to Consumption," this JOURNAL, 32 (1937), 35-39

STANDARD DEVIATIONS OF FAMILY EXPENDITURES IN RELATION TO THEIR MEANS

FOUR SMALL CITIES IN OREGON AND WASHINGTON

Fig 1 FOOD

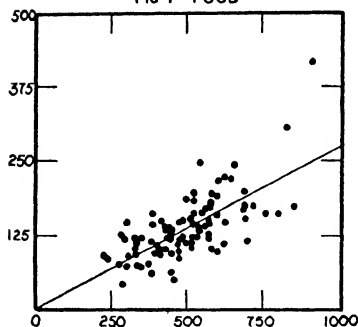


Fig 2 HOUSING

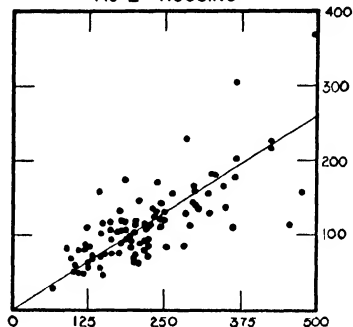


Fig 3 AUTOMOBILE

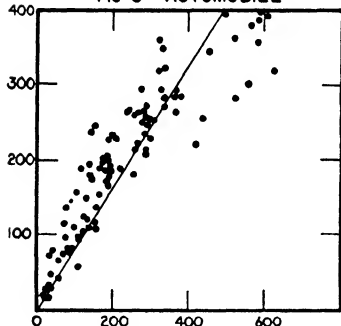
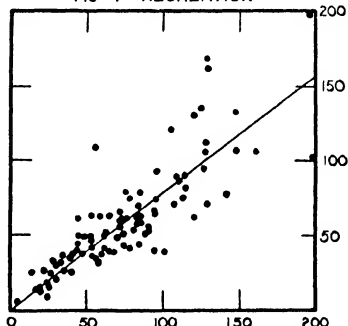


Fig 4 RECREATION



FOUR COUNTIES IN PENNSYLVANIA AND OHIO

Fig 5 PERSONAL CARE

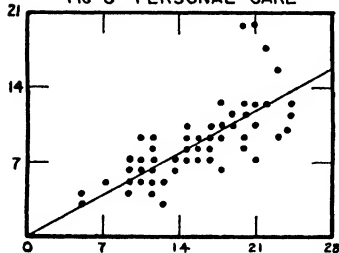
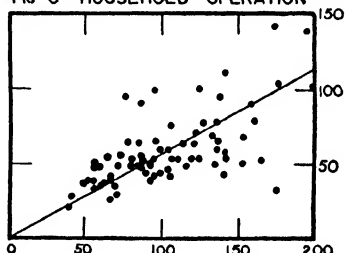


Fig 6 HOUSEHOLD OPERATION



STANDARD DEVIATION IN DOLLARS

MEAN IN DOLLARS

many groups such as food and household operation all families in the class report expenditures. For other groups, such as automobile and tobacco, the number of families having no expense may include as many as half to two-thirds of the families. The distributions of these relatives are moderately asymmetrical in the case of food and clothing and J-shaped in the case of medical care, automobile and furnishings expense. The logarithmic normal curve is found to fit the distributions of total expenditures, food and clothing very well. When the zero expenditures are excluded from the distributions and the means calculated for families having an expense this curve also fits the distributions of medical care, automobile and furnishings expense, but somewhat less well than in the case of expenditures for food and clothing.

DISCRETE FREQUENCY DISTRIBUTIONS ARISING FROM MIXTURES OF SEVERAL SINGLE PROBABILITY VALUES*

BY H. MUENCH

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MANY discrete frequency distributions may be considered as essentially binomial in type. The true binomial distribution is described by two parameters: " p " and " n ". p is a probability ratio while n , the power of the binomial, corresponds to the size of the group upon which p acts. The relative frequency of "successes" due to p , from 0 to n , is given by

$$(1) \quad q^n + npq^{n-1} + n(n-1)p^2q^{n-2}/2! + \dots + p^n$$

where $q = 1 - p$. An example of a true binomial distribution is given by a series of results of tests on groups of animals in which they are subjected to some force of mortality, as is the case in protection tests. n here is fixed, being the number of animals in the test group; p corresponds to the mortality ratio.

The Poisson distribution may be regarded as a special case of the binomial. n and p are both unknown, but np is fixed. n is large (theoretically infinite) and p small, so that np is small, compared to n . The relative frequency of occurrence of successes is given by

$$(2) \quad e^{-m}[1 + m + m^2/2! + m^3/3! + \dots]$$

where $m = np$. In practice the Poisson distribution may be used to describe any series in which n is large and np (the mean) relatively small, so that the distribution is very "skew." A series of worm egg counts in fecal samples may serve as an example, the conceivable maximum count being much higher than the average of the actual numbers.

In a recent paper [1] use was made of certain moment functions of a binomial distribution, denoted by ϕ_n , for the separation of two mortality values in a series of mouse-protection test results. The present paper is devoted to the generalization and systematization of these functions and to examples illustrating their uses.

The first five ϕ functions of a binomial are defined as:

$$(3) \quad \begin{aligned} \phi_1 &= \nu_1/n \\ \phi_2 &= (\nu_2 - \nu_1)/(n)(n-1) \\ \phi_3 &= (\nu_3 - 3\nu_2 + 2\nu_1)/(n)(n-1)(n-2) \\ \phi_4 &= (\nu_4 - 6\nu_3 + 11\nu_2 - 6\nu_1)/(n) \cdot (n-3) \\ \phi_5 &= (\nu_5 - 10\nu_4 + 35\nu_3 - 50\nu_2 + 24\nu_1)/(n) \cdot \cdot (n-4) \end{aligned}$$

* A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 28, 1937.

where ν_i is the i th moment about zero of the distribution. The coefficients in the numerator follow those of the expansion of $n(n-1)(n-2) \dots$ in the denominator. In a simple binomial, each ϕ equals the corresponding power of p . That is, $\phi_1 = p$, $\phi_2 = p^2$, \dots , $\phi_n = p^n$.

Now suppose that a given binomial distribution is made up of different proportions U, V, W, \dots, Z , so that $U + V + W + \dots + Z = 1$. Assume that each fraction of the total arises from an independent value of p : $p_u, p_v, p_w, \dots, p_z$. Then each ϕ is made up of corresponding proportions of the respective powers of the p 's:

$$\begin{aligned} (4) \quad \phi_0 &= 1 = U + V + W + \dots + Z \\ \phi_1 &= Up_u + Vp_v + Wp_w + \dots + Zp_z \\ \phi_2 &= Up_u^2 + Vp_v^2 + Wp_w^2 + \dots + Zp_z^2 \\ \phi_n &= Up_u^n + Vp_v^n + Wp_w^n + \dots + Zp_z^n. \end{aligned}$$

In order to solve for the values of U, V, \dots and p_u, p_v, \dots it is necessary only to calculate a sufficient number of ϕ functions (one for each unknown) and to solve the resulting equations. There are, of course, practical limits: higher moments are untrustworthy in small series, the equations become very complicated as the number of unknowns increases and the power of the binomial must be at least as great as the number of functions to be calculated. Within limits, the procedure is simple and straightforward.

The ϕ functions also correspond to the respective moments about zero (ν 's) of the curve

$$y = kp^x(1-p)^t$$

when the latter is the generating function of a "chain binomial," whose characteristics have been previously outlined [1].

Now we can define another series of moment functions as:

$$\begin{aligned} (5) \quad \Psi_1 &= \nu_1 \\ \Psi_2 &= \nu_2 - \nu_1 \\ \Psi_3 &= \nu_3 - 3\nu_2 + 2\nu_1 \\ \Psi_4 &= \nu_4 - 6\nu_3 + 11\nu_2 - 6\nu_1 \\ \Psi_5 &= \nu_5 - 10\nu_4 + 35\nu_3 - 50\nu_2 + 24\nu_1 \end{aligned}$$

corresponding exactly with the respective ϕ functions except for division by $(n)(n-1) \dots$. It is found that a Ψ function derived from a Poisson distribution equals the corresponding power of the value of $m(=np)$ generating the distribution. If, then, we can assume that a given distribution is made up of a number of independent Poisson distributions, whose proportion of the total is expressed by U, V, W, \dots, Z , and whose m values are $m_u, m_v, m_w, \dots, m_z$, we may set up a series of equations analogous to those of (4):

$$\begin{aligned}
 (6) \quad & \Psi_0 = 1 = U + V + W + \cdots + Z \\
 & \Psi_1 = Um_u + Vm_v + Wm_w + \cdots + Zm_z \\
 & \quad \cdot \cdot \cdot \\
 & \Psi_n = Um_u^n + Vm_v^n + Wm_w^n + \cdots + Zm_z^n
 \end{aligned}$$

Therefore, any set of equations developed for the solution for values of U, V, \cdots and p_u, p_v, \cdots may be used to solve for U, V, \cdots and m_u, m_v, \cdots by substituting Ψ functions for ϕ functions, and vice versa.

Likewise, the Ψ functions correspond to respective moments about zero (ν 's) of the curve

$$y = kx^r e^{-ax}$$

when the latter is the generating function of a "chain Poisson" [2]. The moments of this function are:

$$\begin{aligned}
 (7) \quad & \nu_1 = (r+1)/a \\
 & \nu_2 = (r+1)(r+2)/a^2 \quad \text{etc.}
 \end{aligned}$$

and the solution for parameters is given by:

$$\begin{aligned}
 (7a) \quad & a = \Psi_1/(\Psi_2 - \Psi_1^2) \\
 & r = a\Psi_1 - 1 \\
 & k = a^{r+1}/r! \quad \text{where } \Sigma y \text{ is put equal to } r \text{ and } r! = \Gamma(r+1)
 \end{aligned}$$

In this notation, the elements of the chain Poisson series are expressed by:

$$\left[\frac{a}{a+1} \right]^{r+1} \left[1 + \frac{r+1}{a+1} + \frac{(r+1)(r+2)}{2!(a+1)^2} + \frac{(r+1) \cdots (r+3)}{3!(a+1)^3} + \cdots \right].$$

A given binomial (or Poisson) distribution may therefore be considered as falling within one of the following types:

(1) It arises from a single probability value, and

$$\phi_1^n = \phi_2^{n/2} = \phi_3^{n/3} = \cdots = \phi_n$$

(2) It is a mixture comprised of several components, each generated by a single value.

(3) It arises from a continuous distribution of probability values.

In general, in the two latter cases,

$$\phi_1^n < \phi_2^{n/2} < \cdots < \phi_n$$

In addition, it is possible to conceive of series arising from mixtures of single and continuous probability values. Such mixtures are apparently encountered in the case of protection test results including both negative and positive sera. So far, it has been necessary to handle them by various methods of approximation.

At present there are no criteria which lead to the direct determination of the type of distribution. It seems reasonable to consider, however, that the assumption producing a good "fit" of the observed data presents a fairly good picture of the forces which have produced the distribution in question.

Example A

Table 1 presents the results of a series of single-slide counts of eggs of *S. mansoni*, performed in a village in Egypt by Dr. J. Allen Scott.

TABLE 1
FREQUENCIES OF COUNTS OF EGGS OF *S. mansoni* ON SINGLE SLIDES
(Data of Dr J A Scott)

(1) Number of eggs	(2) Observed frequency	(3) Simple Poisson	(4) Chain Poisson	(5) Zero plus chain Poisson	(6) Zero plus two simple Poissons
0	603	373.8	579.3	{ 297* 297.3	{ 555* 53.9
1	112	339.1	158.2	137.2	100.3
2	93	153.8	76.9	76.6	93.4
3	53	46.5	42.8	45.2	58.3
4	19	10.5	25.4	27.4	28.6
5	21	1.9	15.6	16.9	12.7
6	7	0.3	9.8	10.5	6.5
7	6	0.0	6.2	6.6	4.5
8	5	0.0	4.0	4.1	3.8
9	2	0.0	3.0	2.6	3.1
10	1	0.0	1.9	1.7	2.4
11	2	↑	↑	↑	1.7
12	0	↑	↑	↑	↑
13	0	0.0	2.9	3.0	2.4
14	2	↓	↓	↓	↓
15	0	↓	↓	↓	↓
Total	926	926	926	926	926
Chi square			26.0	15.4	12.8
n			9	8	8
P			0.002	0.05	0.1

* Calculated "Zero" or uninfected component

Each slide represents one inhabitant. It is evident that the distribution follows the general type of the Poisson. The moment functions here are:

$$\nu_1 = 0.907 \overline{127}$$

$$\nu_2 = 3.835 \overline{85}$$

$$\nu_3 = 24.693 \overline{3}$$

$$\nu_4 = 212.825$$

$$\Psi_1 = 0.907 \overline{127}$$

$$\Psi_2 = 2.928 \overline{73}$$

$$\Psi_3 = 14.991 \overline{0}$$

$$\Psi_4 = 101.421$$

Clearly the scatter is much greater than that attributable to a single distribution. Column 3 of table 1 shows the frequencies calculated on the basis of a simple Poisson distribution of $m=0.907$; the deviation from the observed data is very large.

The assumption is next made that the distribution of counts may be explained by a continuous distribution of severities of infection, described by a probability curve. Solving for the constants of the curve by the equations of (7a) we obtain as the generating function:

$$y = kx^{-0.6092}e^{-0.4303x}$$

which gives the calculated results of column 4, table 1. These are in better agreement, but the fit is still not good. On Chi-square test, $P=0.002$.

The assumption of neither class of distribution appears to hold. In fact we should, a priori, expect the series of egg counts to embody a sample of two populations: one non-infected and the other infected, probably in varying degrees. Slides showing no eggs would therefore fall into two groups: those from individuals harboring no worms and those from individuals whose egg counts were so low that the particular slides happened to be negative.

To make the simplest assumption, we say that there is one uninfected component (U) with no eggs ($m_u=0$) and a positive one (V) which can be described by a simple Poisson (m_v). The normal equations become:

$$\begin{aligned} (8) \quad \Psi_0 &= U + V = 1 \\ \Psi_1 &= Vm_v \\ \Psi_2 &= Vm_v^2 \end{aligned}$$

and the equations for solution are:

$$(8a) \quad m_v = \Psi_2/\Psi_1 \quad V = \Psi_1^2/\Psi_2 \quad U = 1 - V.$$

In this particular case, the result is a negative component including 666 slides and a positive of 260 slides following a Poisson with $m=3.2286$. The fit is bad, as might be expected.

It would seem more logical to assume that the positive fraction might be a chain Poisson arising from a continuous distribution of severities of infection. On this hypothesis, the normal equations are, in accord with the equations of (7):

$$\begin{aligned} (9) \quad \Psi_0 &= U + V = 1 \\ \Psi_1 &= V(r+1)/a \\ \Psi_2 &= V(r+1)(r+2)/a^2 \\ \Psi_3 &= V(r+1)(r+2)(r+3)/a^3 \end{aligned}$$

and the equations for solution are:

$$\begin{aligned}
 (9a) \quad a &= \Psi_1\Psi_2/(\Psi_1\Psi_3 - \Psi_2^2) \\
 r &= (\Psi_2a/\Psi_1) - 2 \\
 V &= \Psi_1a/(r+1) \qquad U = 1 - V.
 \end{aligned}$$

The results are shown in column 5 of table 1. In this case, 297 slides are estimated as truly negative, while 629 positive slides are distributed in accord with the curve

$$y = kx^{-0.2946}e^{-0.5283x}$$

The fit is better, but not very good.

In addition to the series of one-slide counts, a series of total counts of three slides was available for the same individuals. From this wider spread it seemed apparent that there were at least two distinct distributions of positive individuals at different levels of infection. If the one-slide counts can be described on an assumption of a negative component (U) and of two different simple Poissons (V, m_v and W, m_w) the normal equations are:

$$\begin{aligned}
 (10) \quad \Psi_0 &= U + V + W = 1 \\
 \Psi_1 &= Vm_v + Wm_w \\
 \Psi_2 &= Vm_v^2 + Wm_w^2 \\
 \Psi_3 &= Vm_v^3 + Wm_w^3 \\
 \Psi_4 &= Vm_v^4 + Wm_w^4
 \end{aligned}$$

and the equations for solution are:

$$(10a) \quad m^2(\Psi_1\Psi_3 - \Psi_2^2) + m(\Psi_2\Psi_3 - \Psi_1\Psi_4) + (\Psi_2\Psi_4 - \Psi_3^2) = 0$$

(where the roots of the equation are equal to m_v and m_w , respectively)

$$\begin{aligned}
 W &= (\Psi_2 - \Psi_1m_v)/m_w(m_w - m_v) \\
 V &= (\Psi_1 - Wm_w)/m_v \\
 U &= 1 - V - W
 \end{aligned}$$

The results of the calculations are given in column 6, table 1. The fit is the best, so far. The hypothetical distributions are:

555 actually negative individuals
 346 lightly infected ($m = 1.8606$)
 26 heavily infected ($m = 7.6965$)

where m is the mean number of eggs per slide. As a matter of fact, the same procedure applied to the three-slide count series yields the following distribution (when the means are reduced to the basis of single slides):

558 actually negative
 351 lightly infected ($m = 2.3206$)
 17 heavily infected ($m = 8.9854$)

These figures, being based on larger fecal samples may be assumed to be more nearly accurate. As might be expected, the observed frequencies indicate a wider scatter than is provided by two simple Poisson distributions. It is evident, however, that the analysis of single-slide counts gives essentially the same picture of infection in this population as do the data for examinations involving some three times the time and effort. This description of infection severity, whatever its shortcomings, does provide constants useful in the comparison of different population groups.

The foregoing example illustrates the general approach to a specific problem, using Ψ functions of a Poisson. Mixed binomial distributions can, of course, be handled by the same equations if ϕ functions are substituted.

Example B

It sometimes happens that binomials of different powers must be considered in one analysis. If there are considerable frequencies in each of a few powers, the best method would probably be to use weighted means of the ϕ functions of each. This would be the case in standard six-animal protection tests, where a considerable number of readings on the basis of five and of four animals has accumulated owing to accidental early deaths of one or two of the group.

On occasion, the binomial powers are scattered over a wide range with a few cases of each. Here ϕ functions may be built up from the individual groups. Let us say that the number dying in a series of n mouse families is represented by $d_1, d_2, d_3, \dots, d_n$, in families of $f_1, f_2, f_3, \dots, f_n$; let $\Sigma f_i = N =$ the total of all mice. Then the weighted value for ϕ_1 will be

$$(11) \quad \Sigma(f_i d_i / f_i) / N = \Sigma(d_i) / N$$

Likewise, the weighted ϕ_2 is

$$(11a) \quad \Sigma[f_i(d_i^2 - d_i) / f_i(f_i - 1)] / N = \Sigma[d_i(d_i - 1) / (f_i - 1)] / N$$

and ϕ_3 is

$$(11b) \quad \begin{aligned} &\Sigma[f_i(d_i^3 - 3d_i^2 + 2d_i) / f_i(f_i - 1)(f_i - 2)] / N \\ &= \Sigma[d_i(d_i - 1)(d_i - 2) / (f_i - 1)(f_i - 2)] / N \end{aligned}$$

This type of problem was presented by data obtained by Dr. T. P. Hughes while attempting to isolate strains of mice susceptible and

resistant to inoculation with yellow fever virus. Each litter was treated as a binomial; the litters analyzed ranged in size from 2 to 15.

Weighted ϕ functions were calculated for three groups of litters: (1) An original unselected group; (2) the first filial generation of families selected as susceptible; (3) another filial generation selected as resistant. Litters of two could obviously not be included in the computation of ϕ_3 , but were included in the lower functions. Analysis was made on the assumption of a mixture of two simple binomials, whose solution has already been published [1]. The results of the analysis are given in table 2.

TABLE 2
ANALYSIS OF MORTALITY OF MOUSE LITTERS TWO SIMPLE BINOMIALS
(Data of Dr T P Hughes)

Group	ϕ_1	ϕ_2	ϕ_3	U	p_u	V	p_v
(1) Unselected	0 5175	0 3008	0 1946	0 745	0 394	0 255	0 784
(2) Filial (susceptible)	8000	6740	5863	215	482	755	903
(3) Filial (resistant)	3824	1613	0809	951	355	049	921

The largest group included only some 60 litters, so that the derived constants cannot be considered very accurate. At the same time, some conclusions may be drawn:

- (1) The original population consisted of families of which about three-quarters showed a low mortality rate (about 40 per cent) and the rest a much higher one (about 80 per cent).
- (2) The first filial generation, selected from presumably susceptible stock, reversed the proportions without showing much change in the basic mortality rates.
- (3) The first "resistant" filial generation retained comparable mortalities but the proportion showing high mortality decreased to about one-twentieth.

Continuation of this analysis over relatively few subgenerations, with sufficient data, should clearly indicate whether these two mortalities could or could not be further modified by additional breeding. There may be other similar applications of the method in genetic studies.

Uses of the Ψ functions have included descriptions of the distribution of counts of branches of larval hairs in races of anophelines, leading to tabulations of probability of identification with any given count. These analyses have involved chain Poisson series beginning at values greater than zero and arising from generating functions with negative second moments [$\Psi_1^2 > \Psi_2$]. There is no opportunity to discuss these functions at this time.

The method outlined in this paper appears to have value in the analysis of discrete frequency distributions. By its use, the following questions may be answered:

- (1) Is a given distribution simple or complex?
- (2) If the latter, what [within limits] is a good description of the factors generating the distribution?

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COMPARABILITY OF MORTALITY STATISTICS*

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ONE of the primary objectives in the compilation of mortality statistics is the presentation of an accurate picture of mortality conditions. This involves the past as well as the present, for it is only in the light of history that we can judge our success or failure, our progress or decline. Although innumerable efforts have been made to bring mortality statistics to the state of perfection where they will serve as adequate criteria for evaluating the progress of general health conditions, there still remains a great deal to be done before this goal has been reached. Numerous factors remain to be evaluated and controlled especially in the study of mortality from specific diseases, for the diagnostic interpretation of conditions causing death partakes of a dynamic character, depending as it does upon the continually expanding knowledge of the medical profession.

CHANGES IN THE INTERNATIONAL LIST OF CAUSES OF DEATH

One of the most important of these factors is the evolutionary character of the International List of Causes of Death. Since its adoption as an international classification system in 1900, it has undergone four revisions and will soon undergo the fifth in preparation for the 1940-1950 decade. These revisions constitute an outstanding example of international cooperation in statistical work as they provide the means of keeping the classification of causes of death in harmony with developments in the science of medicine.

Unfortunately, these decennial revisions disturb the continuity of time series based on mortality from specific diseases, as terms have occasionally been transferred from one rubric to another. Such changes are necessary, of course, to properly reflect the changing attitude of physicians and statisticians toward the various diseases and conditions which contribute to mortality. Persons interested in time trends, however, point out that these changes should have been evaluated to provide a means whereby correction factors could be applied to make the statistics continuous from one decade to the next. To obviate this criticism in the future, the Bureau of the Census plans to classify all deaths occurring in 1940 according to the present as well as according to the new form of the International List. Thus, the means will be provided for adjusting the mortality rates on specific causes between the present and the coming decennial period.

* Condensed from a manuscript read at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 29, 1937.

SELECTION OF THE PRIMARY CAUSE OF DEATH

Practically all published mortality statistics are based on the principle that each death can be represented by a single cause. If all death certificates recorded but one fatal condition this principle would stand without question, and the International List would in itself suffice for classification purposes. However, a large proportion of death certificates contain more than one cause, thereby necessitating the use of some definite method for selection of the cause under which the death is to be tabulated.

In 1935 the Bureau of the Census undertook a study of the differences among various countries in selection of the primary cause of death. A list of 1,032 deaths, each showing two or more causes, was sent to forty-one countries. These cases were selected as representative of coding problems rather than as a random sample of death certificates; therefore, the returns must be interpreted qualitatively rather than quantitatively. Of the eighteen replies received, eleven (including the United States) were from countries using the detailed form of the International List for 1929. Preliminary study of the returns from these eleven countries indicates a marked variation in assignments. (See the accompanying table.)

PERCENTAGE OF AGREEMENT WITH THE UNITED STATES AND WITH ENGLAND AND WALES IN SELECTION OF PRIMARY CAUSE OF DEATH

Nation	Total deaths		Infant deaths		Puerperal deaths		Tuberculosis deaths		Cancer deaths	
	US	EW	US	EW	US	EW	US	EW	US	EW
United States	—	62	—	50	—	53	—	72	—	98
England and Wales	62	—	50	—	53	—	72	—	98	—
Australia	85	65	89	48	80	60	95	72	94	95
Canada	61	72	58	73	76	68	89	65	88	90
Ceylon	89	65	89	53	84	44	97	74	95	93
Holland	56	63	59	56	64	58	49	50	86	88
Italy	58	61	62	59	63	56	74	68	83	90
New Zealand	81	64	81	49	77	37	87	77	98	97
Philippine Islands	83	64	80	53	79	56	87	75	93	93
Scotland	60	59	48	59	63	60	65	81	94	93
Union of South Africa	50	65	56	63	62	76	57	79	87	95
Average	68.5	64.0	67.2	56.3	70.1	56.8	77.2	71.3	91.6	93.2
Number of cases	1,032		89		70		54		66	

For all of the 1,032 cases the relative agreement of each of the ten countries with the United States ranges from 50 per cent to 89 per cent, the average being 68.5 per cent. In the case of the 89 infant deaths included in the list, the agreement is slightly lower. Agreement for the 70 puerperal deaths is higher, the average being 70.1 per cent. For the

tuberculosis deaths the average rises to 77.2 per cent and for cancer it is 91.6 per cent. Comparison of these countries with England-Wales shows that the average agreement is lower than with the United States except for deaths due to cancer. It is not claimed that the differences resulting from various systems of selecting the primary cause of death are accurately measured by this study, but it is evident that comparison of statistics on specific causes of death among the nations represented in this study may lead to erroneous conclusions even though these statistics are based on the International List.

The following alternatives suggest themselves for the removal of the discrepancies arising from the use of different systems of selecting the primary cause of death: (1) that nations now agreeing in the use of the International Nomenclature extend that agreement to a uniform system of selecting primary causes of death for tabulation, or (2) that studies be made upon an international basis for evaluating quantitatively the effect of these differences. To indicate the proportion of death certificates actually involved in such selection, tabulations showing the relation between primary and contributory causes of death are now being made by the following countries which are to be represented at the International Conference: Australia, Canada, Denmark, England, Germany, Greece, New Zealand, Panama Canal Zone, Scotland, Switzerland, and Turkey. These tabulations should prove invaluable in demonstrating the importance of the whole question of primary cause selection. As its contribution, the United States will submit multiple cause tabulations for all deaths that occurred in the United States during 1936, together with special studies on international coding practices.

ACCURACY OF CAUSE OF DEATH REPORTING

Another factor, less tangible, less definable, but really more fundamental, is the accuracy with which causes of death are reported on death certificates. Although not so commonly recognized as an important factor, because of its remoteness from the final results, it nevertheless constitutes one of the most important problems in the field of mortality statistics. This is shown by a study¹ carried on in Westchester County, New York, during 1933, on the reporting of deaths from syphilis and alcoholism, in which it was found that mortality from these two causes was more than 50 per cent underreported. To what degree this holds true in other localities and for other diseases is not known. One way in which to establish a partial check of this particular problem is to determine the accuracy of cause of death state-

¹ "Effect of a Confidential Inquiry on the Recorded Mortality from Syphilis and Alcoholism," M. Nicoll, Jr., M.D., and M. T. Bellows, *American Journal of Public Health*, Vol. 24, No. 8, Aug., 1934, pp. 813-820.

ments on death certificates by comparing them with autopsy records. More studies of this nature are required before results will be obtained which can be used to measure present mortality returns with any degree of certainty.

It has been suggested that a certificate on which the cause of death is strictly confidential would solve this problem. Switzerland and Holland have been using such a certificate for some time, but to our knowledge have not analyzed the effect of confidential reporting on their mortality statistics. No real trial has been made of the suggestion in this country, although in one of our large cities efforts are being made to do so. It appears, therefore, that there is little factual evidence at hand demonstrating the degree to which cause of death statistics might be improved by means of a confidential reporting system.

TERMINOLOGY

Closely allied to the question of accuracy in the reporting of causes of death is the terminology used by the doctors and coroners who are responsible for information on death certificates. In spite of the fact that the cause of death is one of the most important basic factors in mortality statistics, many of the certificates filed do not contain this information in satisfactory form. Terms indicating only symptoms or minor associated conditions are frequently reported and operative terms, patently recognized as nonfatal, are very often used. Prior to 1935 the Bureau of the Census returned thousands of such records to the reporting physicians each year, in many cases nine to twelve months after the death occurred. This function has now been taken over by practically all State health offices with a noticeable improvement in the speed with which returns are obtained. However, the use of a completely satisfactory cause of death terminology can hardly be developed among the physicians of this country until they have been imbued with a fuller realization of the meaning of mortality statistics. This realization can best be brought about by education, preferably by the introduction of intensive courses on vital statistics in our medical schools and colleges. Until then the nomenclature upon which mortality statistics are based must continue to retain many terms that are not acceptable.

FORM OF CAUSE OF DEATH QUESTION ON DEATH CERTIFICATE

Underlying the accuracy and completeness with which causes of death are reported on the death certificate is the form in which the cause of death question is asked. On first thought this may seem a simple matter, but the experiences of various countries which have studied the problem, prove that the opposite is true.

For instance, the present English certificate requires the reporting physician to give first the "Immediate cause of death," next "Morbid conditions, if any, giving rise to the immediate cause," and last "Other morbid conditions." After considerable experimentation the English authorities concluded that this form of question elicited results sufficiently accurate in most cases to permit classification directly, i.e., on the basis of the doctor's statement.

In contrast, the certificate used in the United States requires the doctor to report first the "Principal cause of death and related causes of importance," and second "Other contributory causes of importance," with dates of onset whenever possible. This form of question has not been satisfactory in eliciting the proper sequence of morbid conditions. Consequently, an arbitrary system of selecting the primary cause for tabulation was developed, namely, the *Manual of Joint Causes of Death*.

A considerable demand has arisen for revision of the present American certificate. In order to obtain a broad clearance of this question, the Bureau of the Census during the latter part of 1937 mailed over 6,000 questionnaires to individuals and organizations interested in vital statistics. With regard to the questions on cause of death, an opinion was asked as to the advisability of adding the following item for the doctor's attention, "To which cause should death be assigned?" The physicians' answers could then be tabulated and compared with the statistics resulting from the method of selecting the primary cause of death by the use of the *Joint Cause Manual*. By this expedient, it would be possible to determine the relative agreement or disagreement between the opinion of the medical profession and the arbitrary selection of the primary cause of death by the use of the *Joint Cause Manual*.

CONCLUSION

Now that the *International List of Causes of Death* has been quite generally adopted as a standard basis of nosological classification, it is necessary to press forward toward the solution of other elements in the problem of making mortality statistics truly comparable. Under-reporting of certain types of disease conditions should be studied and corrected if possible. Terminology used in the reporting of causes of death should be standardized, especially in its interpretation for statistical purposes. The manner in which the reporting physician is requested to supply information should be brought into alignment with modern practice. Above all, the method of selecting the cause under which the death is to be tabulated should be standardized among the various agencies engaged in the compilation of vital statistics.

NOTES

THE ASSOCIATION OF AGRICULTURAL PRICE FLUCTUATIONS

The general equilibrium theory regards a price as functionally related to all other prices. Some of the connections are simple and direct; for example, one commodity may be a substitute for another or be an important raw material utilized in its production. Other relationships may be more remote or the connections may be even so attenuated as to have little real meaning. It should be possible to begin with a single price and starting with closely associated prices trace the varying degrees of relationship out to groups of relatively unrelated prices, in short to lay out a pattern of the position of this price in the system of prices. Knowledge of these relationships is of importance in understanding the connections of prices and as a preliminary step in the study of the transmissions of influence through the price system. This note presents an exploratory study of an important group of agricultural prices.

The prices included in the study are the average farm prices reported for the United States by the Department of Agriculture on December 1 of each year, except butter and eggs which are yearly averages of wholesale market prices. Thirteen commodities have been compared for the period 1910 to 1936. Each individual price has been reduced first to a price relative using as a base the average price for that commodity over the entire period. The ratio of the price relatives of the two commodities to be compared then has been computed for each year of the series. This gives the relative prices of the quantities of the respective commodities which have averaged a dollar in price over the entire period. When the prices of two commodities have about the same relative changes throughout the period and are positively correlated in their movements the ratios do not differ greatly from 100, but when the prices do not have similar fluctuations or are negatively correlated in their movements the ratios may vary greatly. The variation in these ratios may thus be taken as a measure of the association in the price movements, a small variation indicating a high positive association and a large variation a lack of association or a negative association. Our interest here is in the positive association and, in consequence, the small variation. A part of the change in these ratios may be due to trends in the prices of the commodities. Over such a long period of time gradual and considerable changes in demand and productive technique may take place. Since we are concerned only with the association of prices in the shorter periods, the ratios have been re-

duced to logarithms and a trend fitted by the method of least squares. The deviations from this trend have been computed and their standard deviation found. This has been taken as a measure of the similarity of the price movements of the compared commodities. For convenience, the logarithmic values of these standard deviations have been reduced to numbers, and serve as an index of the closeness of relationship. If two prices had the same relative fluctuation throughout the period, except for the trend of their relationships, the standard deviation of their price ratios would have been zero. Where the standard deviation is large, prices have had dissimilar movements. The values of these indexes are given in the accompanying table.

TABLE 1
STANDARD DEVIATIONS OF RATIOS OF PRICE RELATIVES OF VARIOUS
AGRICULTURAL PRODUCTS, 1910 TO 1936

	Corn	Oats	Rye	Barley	Flax	Cotton	Pota- toes	Hogs	Cattle	Sheep	Eggs	Butter- fat
Wheat	22	21	15	24	23	38	36	26	38	25	32	31
Corn		14	21	19	28	40	49	32	38	33	43	36
Oats			17	12	24	42	45	35	36	35	36	31
Rye				19	27	44	43	36	40	32	35	36
Barley					26	45	52	39	44	41	41	37
Flax						33	39	33	38	29	32	30
Cotton							57	45	54	34	43	39
Potatoes								38	45	42	39	42
Hogs									33	22	32	24
Cattle-calves										31	35	27
Sheep-lamb											32	27
Eggs												18

As would be expected the closest group of price relationships is found among the feed grains, oats, corn, barley, and rye for all of which the values of the index are below 22. Only three other relationships have values this low and these are wheat-rye, eggs-butterfat, and oats-wheat. The livestock prices, cattle, hogs, sheep, and butterfat form a second group somewhat less closely related than the feed grains, but nevertheless with all the indexes lying between 22 and 33. The relationships between livestock and feed prices are less close than those among the livestock themselves or the feed grains themselves. The livestock-feed price indexes lie between 31 and 44, the closest being oats-butterfat at 31 and corn-hogs at 32. Cotton and potatoes are unrelated to the other groups or to each other, the highest index of 57 occurring between them. The lowest values found for cotton were with flax, 33, and sheep, 34. The lowest value for potatoes was 36 with

wheat. In general the relationship between the prices of the cash crops of wheat and flax and livestock were closer than between the prices of feed crops and livestock. Eggs were less closely related in price to the other products than butterfat, even though the relationship between the prices of eggs and butterfat was close. When the indexes are arranged in a frequency the range is from 12 for oats-barley to 57 for cotton-potatoes, and the median value is 35. The relationships between the feed prices and between the livestock prices lie below the median. The feed grain-livestock relationships begin close to the median and are mostly above. The relationships between cotton, potatoes, and eggs and the other products are almost all above the median.

The results support the preliminary hypothesis and are suggestive for further analysis. A wide range in price association is disclosed with groupings of commodities at different points for particular sorts of relationships. Extension of this type of analysis over a wider range of commodities would provide a better factual background for the equilibrium theorist in his study of the price structure in operation. It is also significant for problems of price analysis in showing what prices are sufficiently isolated to be subject to individual attack and which are so completely interwoven with others to be best subject to a group analysis. Finally, there are indications of the route by which specific changes may be transmitted through the price system.

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BIG BUSINESS, ITS GROWTH AND ITS PLACE

In the December number of this JOURNAL there appeared a review by Mr. Gardiner C. Means of the Twentieth Century Fund book, *Big Business, Its Growth and Its Place*, of which we were principal authors. This review appears to us to be so unfair that, in justice to ourselves and the organization under whose auspices the study was conducted, we think necessary a letter of protest.

In the first place the discussion of the rise of large corporations is not, as Mr. Means said, "devoted almost solely to summarizing two well-known studies of industrial mergers." Citations were made not only from Thorp and Watkins but also from Berle, Davis, Gerstenberg, Seager and Gulick, Moody, and the Census. In addition to that Mr. Means has read the original manuscript of which this book is a partial summary and therefore must have known that the history of over 300 large corporations was traced back from their own reports in order to ascertain the date when they were formed and that exhaustive studies were made of their assets and profits since 1900.

Mr. Means stated that there was no indication given as to how the figures representing the percentage of the national income produced by corporations

were arrived at. But on page 15 of the book there is a table showing the method used for manufacturing and for mining, and the sources are cited in the footnote on page 17. Here again Mr. Means has seen the original manuscript and must therefore have known the method used. It is necessarily rough, but we have heard of no better method. Very likely the method we used exaggerates the importance of corporations because the Census omits the smallest units, which are usually not incorporated.

Mr. Means's criticism of the discussion of the proportion of assets owned by large corporations is apparently based on the assumption that *assets owned* should be interpreted to mean *property controlled*. The difference between the two concepts is referred to several times in the book, especially in the very last paragraph of the conclusions. The income tax statistics do not show as consolidations all of the corporations that might properly be termed such. They do, however, show for each controlling company the value of its holdings in other corporations, and that is the proper figure to use when talking of assets owned.

Similarly with reference to the income received by parent companies, all dividends and fees received from subsidiaries are included in the parent companies' reported net income. Consequently the underestimate of income of consolidations would consist only in the amount of income earned by subsidiaries that was not distributed. It would not even equal the whole of that, because the minority interests would be entitled to part of it. In 1933 there is every reason to suppose that the amount of income earned by subsidiaries that was not distributed was very small, since the parent companies needed the money. Consequently if there is any underestimate of the proportion of income received by large corporations it is probably very slight.

Mr. Means's theoretical argument concerning integration is sound, but it is largely offset by three facts. One is that if integration causes the compiled receipts of large corporations to appear smaller than they otherwise would, it is equally true that the figure for total compiled receipts of all corporations is also too small. Consequently one partly offsets the other. Another offset is that the relation of gross sales of large corporations to those of all corporations was slightly less in those industries where gross sales were reported than the ratio of total receipts. The ratio of gross sales less cost of goods sold was also less than the ratio of total receipts. By using figures for total receipts instead of gross sales, part of the theoretical underestimate has been allowed for. No other figures exist that can be used to ascertain the relative importance of large corporations and small corporations in each industry. The third offset is that vertical integration which might cause an under estimate of the importance of large corporations is important only in manufacturing, mining, and trade but not in public utilities and transportation where giant corporations are most common.

Mr. Means postulates a figure of 32.3 per cent which he says was used to apportion the national income produced by corporations. In a footnote he admits that the figure 32.3 per cent is not presented directly in the report.

As a matter of fact such a figure was not used at all. Each industry was studied separately in the light of the best figures available.

It is hard to understand how Mr. Means can insist that governments should be regarded as large corporations, in view of the fact that the present agitation against large corporations is based mainly on the fact that they are privately controlled, and the most popular remedies proposed involve having the Government take over some of the functions of large corporations. This book was a study of big business. It is certainly inconsistent with common usage to regard governments as being in the class of big business. They may or may not be legally incorporated, but they are presumably not run for the profit motive, they declare no dividends, and in the election of their directors and officials the number of votes cast by each voter is not based on the amount of his investment.

As for the accusation of bias, the reader will have to reach his own conclusions on the basis of his knowledge of the reputation of the Twentieth Century Fund, which sponsored the study, of the personnel of the Committee, which supervised the project, and of the research and editorial staff, which was directly responsible for the study. If the findings presented by the staff in an honest effort to discover the facts are not in conformity with Mr. Means's convictions, it is just possible that the fault lies with Mr. Means and not with the report.

RUFUS S. TUCKER

ALFRED L. BERNHEIM

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In the effort to show unfairness in the review of *Big Business, Its Growth and Its Place*, Mr. Tucker and his associates deal with five questions of fact and two questions of opinion.

On four of the five questions of fact they would appear to have taken untenable ground.

1. They name six works in addition to those referred to in the review which they claim are cited in the discussion of "the rise of large corporations." Actually only two, Moody and the Census, are cited with respect to large corporations, less than a full paragraph being devoted to each. Berle, Davis, Gerstenberg, and Seager and Gulick are cited only in reference to the "growth and extent of incorporation." This leaves the discussion of the rise of large corporations "devoted almost solely to summarizing the two well-known studies of industrial mergers" (Thorpe and Watkins), as stated in the review. It is not clear just what relevance material in an unpublished manuscript has to a criticism of paucity of content of the book actually published.

2. They claim that the methods employed in arriving at two of the 10 figures in the table on page 17 which represent the percentage of national income produced by corporations were given in a table and footnotes of a

preceding page. Actually, the figures in the two tables are different, are listed under different captions, and no reference is anywhere made to indicate a connection. One is left to rely on the footnote: "Sufficient space is not available to explain the methods used to arrive at the estimates of the percentage of income produced by corporations." If an indication had been given that the "value of product" was used in estimating the percentage of "income produced," the reviewer would have criticized the application of this method to manufacturing when equally reliable figures on "value added" are available.

3. The authors draw a quite appropriate distinction between assets owned and property controlled, claim that this distinction has been referred to in the book and suggest that the reviewer erred in assuming that the Twentieth Century Fund report was primarily concerned with property or assets controlled. Actually the above distinction is neither discussed nor maintained in the book. In the same or consecutive pages the assets of the same group of corporations are referred to as assets owned and assets controlled (pages 5 and 6; page 67). The only figures given and referred to as "assets owned" are derived from partially consolidated income tax returns and therefore include some assets controlled as well as "assets owned." The whole thrust of the book in so far as it is concerned with wealth is around the concept of "assets controlled." The chapter on the "Concentration of Corporate Wealth," which starts off with the question "What proportion of business assets of the nation do the large corporations *own*?" (page 54); goes on to give only figures of assets derived from consolidated income tax returns, which include a large body of assets controlled but not owned by the parent companies; indicates that the concentration of wealth "is to some degree understated because certain corporations controlled by others are separately reported" (page 56); and ends up exemplifying the statement that "the giants control a slightly larger percentage of capital assets than they do of total assets," by citing figures referred to as dealing with the land, buildings and equipment "owned" by the large corporations yet actually including the land, buildings and equipment owned by subsidiaries of such holding companies as the United States Steel Corporation, which *own* almost no tangible assets (page 67). Even the closing paragraph in the book, the only concrete evidence offered by Mr. Tucker and his associates to indicate that the distinction between "assets owned" and "property controlled" had been maintained, fails to support his contention. It appears to be concerned with a different type of control than that exercised through property rights and makes *no reference at all* to the distinction between "assets owned" and "property controlled."

There is no question that the figures for assets or wealth *owned* by the largest corporations would be smaller than those for assets *controlled* by them directly or through stock ownership. Which is the more significant figure in discussing "big business" and the "concentration of corporate wealth" can be a matter of opinion. But the figures on corporate assets presented in the book are more nearly assets controlled than assets owned,

and indication is given that, if complete consolidation had been feasible, the figures for assets controlled would have been the ones given. The pretense that the figures represent assets owned must be an afterthought on Mr. Tucker's part.

4. According to Mr. Tucker and his associates the reviewer has insisted "that governments should be regarded as large corporations." This is simply not true. The reviewer objected to the inclusion of Government figures in data purporting to cover the categories "medium or small corporations, firms not incorporated and individuals," and the category "all business activity in the United States." An insistence that Government figures be excluded from data on medium or small *business* does not constitute an insistence that Government be classed with large business corporations. The authors, in their criticism, agree that Government is not "business." A tripartite division is clearly called for.

The authors do point to one minor error in the review. The book clearly sets forth the method used in allocating the "national income produced by corporations" in each major branch of industry between large and smaller corporations but does not give the percentages actually used in making the allocation. Since the proportion of corporate assets controlled by large corporations is given, the reviewer, for purposes of comparison, calculated the corresponding figure for national income produced by corporations from the data given in Table 25. Inadvertently, reference was made to this figure as the basis for allocating the national income produced by corporations between large and smaller companies when actually the allocation was made for each major branch of industry separately. The corrected statement should read: "Once the questionable percentages underlying this figure of 32.3 per cent are arrived at . . ." instead of "Once this questionable figure of 32.3 per cent is arrived at. . . ." This error as to the method of calculation is most unfortunate even though the method of calculation was not germane to the paragraph in which the error occurred.

Of the two matters of opinion, the *magnitude* of the error due to the use of compiled receipts is a question which can only be answered by obtaining more adequate data; on the question of bias, no accusation of general bias was made. Rather evidence was given to show a statistical bias causing the figures obtained to minimize seriously the degree of corporate concentration. Evidence was also given of minor cases of verbal bias. These evidences have not been refuted in the communication above.

GARDINER C. MEANS

National Resources Committee
Washington, D. C.

The chapter on the rise of large corporations cannot be logically considered apart from the chapter on the growth and extent of incorporation but if it is so considered the fact is that only three pages out of twelve and a half are devoted to summarizing Thorp and Watkins. A fair reviewer is presumed to

consider not only the material presented but the thoroughness of the study on which the presentation is based, if he has knowledge of it.

Mr. Means was able to recognize rounded numbers when it suited his purpose in his original review; it is a pity he could not recognize that 92 and 96 are rounded forms of 92.1 and 95.7. If "Value Added" had been used for manufactures instead of "Value of Product," the figure would have been 91.5 and the importance of corporations would have been slightly reduced.

In his original review Mr. Means criticizes the book for not using consolidated statements except to the extent that income tax returns were based on them. That procedure, he said, "appears to minimize the true degree of concentration (of corporate wealth)." Now he criticizes the book because it did use consolidated statements for corporations making consolidated tax returns, on the ground that consolidated returns "included a large body of assets controlled but not owned by the parent companies" and therefore overstate the wealth of corporations. The procedure used in the book was necessitated by the nature of the material, as Mr. Means must know. Since the privilege of filing consolidated returns was limited to corporations owning at least 95% of the stock of their subsidiaries, the assets reported are for practical purposes assets owned, subject to the same sort of claims by creditors that the assets of any independent corporation are subject to, and the claims of the minority stockholders (if there are any) are too insignificant to worry about.

We insist that Government activity, if considered as a part of business activity, is not in the hands of corporate giants, and that the second statement of page 98 to which Mr. Means objects is true. The preceding statement on that page should have read "80% of all non-governmental economic activity," instead of "81% of all economic activity," to conform to the table on page 95—an unfortunate error which we regret.

It is impossible in a limited space to refer to other misstatements in Mr. Means's reply. We still believe that with all his innuendoes he has been unable to show any justification for his charge that the book is biased, either statistically or verbally.

RUFUS S. TUCKER

ALFRED L. BERNHEIM

MARGARET GRANT SCHNEIDER

REVISION OF THE BASE PERIOD FOR GOVERNMENT INDEX NUMBERS

The Washington Statistical Society held a meeting on February 28 to discuss the proposal to change government indexes to a recent base period. Morris A. Copeland, executive secretary of the Central Statistical Board, presided, and representatives of several statistical agencies led the discussion. The talks were pointed toward three questions:

1. Is a revision of the base period for government index numbers desirable?

2. If a change is made, when should it become effective?
3. What are the pros and cons of 1935-1937 as a new base period?

Maxwell R. Conklin of the Division of Research and Statistics of the Federal Reserve Board made no definite recommendation for change and cautioned careful study before a shift is made. The 1923-25 base used by the Board for its indexes, while a good base when it was adopted, has in recent years developed several weaknesses that limit its value for current use: (1) residential building activity was at a peak during the 1920's and in the years since the indexes for building and building materials have been low in comparison with other series; (2) changes in technology and in demand have caused marked shifts in the relationships between individual series; (3) no composite index number involving both price and volume is reliable over a long period of years; (4) a number of series, such as production of liquors and glass containers, man-hours, etc., have assumed importance or become available only recently and cannot be extended to a fifteen-year old base period.

The change to a 1935-1937 base would have little effect on the level of the Board's general production index or the group indexes of manufacturing or mining, but it would make considerable difference in the relationships among many individual series. A later base would facilitate the use of new weights for component series, but it should be kept in mind that the weight period and the base period do not have to be the same and one may be changed without changing the other. In all recent years, including the proposed 1935-1937 base period, building activity has been at a low level and prices and volumes generally have shown sharp fluctuations. In view of these conditions, it is doubtful that relationships prevailing in the 1935-1937 period will be indicative of the future. While recognizing the need for a more recent base, Mr. Conklin pointed out the difficulty of selecting a specific period that would be sufficiently stable to justify a change in the base of government index numbers generally and advocated postponing a decision until 1939 or 1940 when additional information would permit more careful consideration of the problems involved.

Lowell J. Chawner of the Division of Economic Research, Bureau of Foreign and Domestic Commerce, noted three general considerations in the choice of a base period: (1) public users of general index numbers, whether professional statisticians wish it or not, frequently attach the concept of normality to a base period; (2) the formulas most commonly used at the present time involve the use of base period weights or a variation thereof; (3) the dispersion of the component relatives from a base should be as small as possible.

Although many conditions such as the development of new primary statistics tend to form a change in the base period, Mr. Chawner said no recent period has the characteristics which would justify a shift at the present time. He felt definitely that 1935-37 would not be a satisfactory base since they were years of considerable instability in prices, with sharp declines in production during the latter part of the period. The relative importance of

durable and non-durable goods, and the relationship between employment and payrolls during this period is not likely to be typical of the next 10 years. The influence of payments of the veterans' bonus, government payments to farmers, and relief expenditures contributed in making the period an abnormal one. Relatives based on this period would soon show a greater dispersion than if an old base were retained.

Mr. Chawner said that in his judgment a question of greater importance than changing the base year is that of establishing comparable classifications between various series.

Miss Arynness Joy of the Bureau of Labor Statistics, on the other hand, said that from the viewpoint of the Bureau a change was unavoidable and imperative for certain indexes prepared by the Bureau, and stated that it would be necessary to put it into effect as soon as possible. All agencies cannot be expected to make the new base effective at the same time, but the B.L.S. has certain series in process of revision which involve a change of base.

While the Bureau of Labor Statistics is open to conviction as to the dates of the period, it must include or be subsequent to 1935. There has been a great expansion in the primary data available since then, which should be related to the base period. The cost of living division, for example, is completing a study of consumer purchases covering the years 1934-36 which will provide new weights for both cost of living and retail price indexes and will be the basis for introducing new commodities into these series. Anticipating this change, the retail price division has been collecting prices on many new items of food, clothing, furniture and rents which, individually, cannot be satisfactorily related to any base prior to 1935, and for which no price relatives could be published on an early base.

In wholesale as in retail prices extensive revisions of the component series are under way, and it is exceedingly difficult to obtain prices for earlier years. In the important field of employment and payrolls, the base period for the manufacturing series is 1923-25. Non-manufacturing industries were not covered until 1929 and that year serves as their base. Data on man hours were not collected until 1932.

Miss Joy stressed the importance of making available estimates in the form of absolute figures instead of or in addition to index numbers when possible.

O. C. Stine of the Division of Statistical and Historical Research, Bureau of Agricultural Economics, agreed that a recent base period was desirable, but said that no decision should be made until 1941. We are too close to the 1935-37 period to see it in the necessary perspective. A satisfactory base should be somewhere near the median of extreme fluctuations and should be years of relative stability when the various component series run approximately parallel. Taxes, interest payments, farm wages, etc. should be in stable relationship. A three-year base, in Mr. Stine's opinion, is not long enough; a period of five, six, seven or even ten years would be preferable.

The Department of Agriculture is at present tied by legislation to a pre-

war base, 1910-14. As a temporary expedient, 1924-29 has been chosen as a base for farm wages, one of the newer series.

Leifur Magnusson of the International Labor Office recommended waiting until there might be joint consideration by the I.L.O. looking toward the possibility that I.L.O. indexes and possibly those of some of the individual countries might be on the same base. An international committee might be set up.

Mr. Magnusson spoke of the desirability of having published actual figures rather than index numbers whenever it was possible. For the more uniform series such as hourly or weekly wages, and hours per week the absolute figures are most useful for most purposes. He acknowledged that index numbers were necessary for complex series such as cost of living.

General discussion from the floor followed the scheduled talks. There were divergent opinions as to whether weights should be drawn from the same period chosen for the base. In response to a question, Mr. Wilcox of the B.L.S. said that one reason why 1935-37 had received favorable consideration as a base period was that it included two Census of Manufactures years.

The whole problem of the choice of a recent base period will receive further attention through the Central Statistical Board's Committee on Techniques of Statistical Analysis.

Subsequent to the meeting, Mr. Magnusson received a letter from Mr. John W. Nixon, Chief of the statistical section of the I.L.O. in Geneva, in which he treated the question of the base period. An excerpt from Mr. Nixon's letter follows:

... this is a rather difficult question. It is one which concerns various branches of statistics, and has been discussed by the Committee of Statistical Experts of the League of Nations, which decided in December 1933 that:

- (1) No post war period satisfies fully the conditions desirable for a uniform base period for economic index numbers;
- (2) In view of the impossibility of foreseeing at present and at what levels a relative equilibrium will be reached, it would seem premature at this stage to attempt the realization of recommendation IX of the Conference relating to economic statistics.

I think this position still holds and that it is too early to fix any new base period. The difficulty is to find a normal period. The years 1934-36 do not appear to have been very normal in the U.S.A. The indexes of employment and payrolls fluctuated more during this period than during the years 1925-27 and were, moreover, considerably below the level of these years. For our own publications, we convert index numbers of cost-of-living, wages, employment, etc. to the base period 1929 and the League of Nations does the same in its statistical publications. We found it necessary to adopt some uniform base period for our international tables in view of the different base periods used in the different countries, otherwise comparisons of fluctuations would be impossible, and 1929 was adopted

for convenience, and as being one of the most normal of recent years. I think the matter will be taken up on the international plane in due course, but the present time is, in my view, somewhat premature.

PROGRESS OF WORK IN THE CENSUS BUREAU

CENSUS OF MANUFACTURES

The collection of data for the 1937 biennial census of manufactures began last January with the mailing of about 230,000 schedules to establishments on the Bureau's list. Many of these will be eliminated later because the concerns have gone out of business or are not manufacturers or do not have an annual value of products amounting to \$5,000. Perhaps 180,000 will be included in the census. Up to the end of April about 115,000 of the schedules sent out had been filled in and returned. Follow-up correspondence for the purpose of obtaining data needed for the correction and completion of defective returns is necessary for about one-third the schedules received.

At one time the data for the census of manufactures were collected through a field canvass conducted by special agents employed to visit all manufacturing concerns and fill in the schedules. In the quinquennial census for 1914, a force of 1,300 special agents was organized for this undertaking, and the cost of the field work was approximately \$500,000. The present practice, which began when the census was made biennial in 1921, is to collect the schedules by mail so far as possible. But as not more than 75 per cent of the schedules are obtained in that way, it is still necessary to employ agents in the field to get in returns from delinquents and to obtain the correction of faulty schedules received by mail and not corrected by correspondence. The agents—approximately 150 in number—are not appointed until the mail collection has been in progress for about three months. They are local men most of whom have had previous experience in this work, covering in many cases three or more censuses. A number of the employees on the permanent force of the Bureau are sent out from Washington to “clean up” the work in large cities. It is estimated that the cost of field work for the current census will not be over \$100,000.

This great reduction in the cost of census taking now as compared with earlier censuses, however, is not due entirely to the change in the method of collecting the data. It is partly the result of eliminating from the canvass the smaller establishments—those having an annual value of products below \$5,000. This change—made when the census began to be taken biennially—reduced the number of establishments to be canvassed by 22 per cent but made a difference of less than 1 per cent in the total number of wage earners and the total value of products.

One new feature of the 1937 census is the collection of inventory data to be reported for both the beginning and the end of the year under two heads: (a) finished products of the plant and (b) materials, supplies, fuel, work in progress, and all other inventories. There is an urgent demand for informa-

tion of this kind, and the attempts to collect it that have heretofore been made both by governmental and by independent agencies have not been very successful.

The final report of the 1935 census of manufactures, a volume of about 1,300 pages, will be off the press by June 1. Practically all the material it contains has been published in series of State and industry reports, which had all been issued or sent to the printer by the end of August, 1937.

MEASURING TOWNSHIP AREAS

During January, 1938, the Bureau began the work, financed in part by W.P.A. funds, of measuring the areas of townships and other minor civil divisions in certain states. Provided funds are made available during the next fiscal year, it is anticipated that all of these areas in the United States will be measured in time to be included in the reports of the Sixteenth Decennial Census.

This will make it possible for the first time to give density statistics for minor civil divisions and to map density areas defined by the boundary lines of these divisions. Heretofore the smallest political division for which such data could be given was the county. It is anticipated that the minor civil division figures will be used in the preparation of a large scale population density map of the United States.

This mapping work was not undertaken prior to the Census of 1930 because of the inadequacy of the map records in many states. But the mapping programs of the past few years, notably those of the Tennessee Valley Authority, the Geological Survey and the Coast and Geodetic Survey, have furnished or will furnish state and county maps of sufficient accuracy.

Measuring the minor civil divisions of the United States is part of a long range program, which has included the preparation of a complete map record of every census area and the publication and sale, at a nominal cost, of state minor civil division outline maps for the Census of 1930. In preparation for the census of 1940 these maps will be revised to conform to changes in the boundaries of political divisions made since 1930 and to utilize the more accurate map data now available.

TABULATION OF UNEMPLOYMENT REGISTRATION COMPLETED

The data secured during the week of November 16-20, 1937, in connection with the registration of the unemployed and partly unemployed have now been tabulated and published. The preliminary count, showing three classes by sex, was completed before the end of December; the results of this count were given to the press early in January and published on January 18, 1938, in the form of a preliminary report giving statistics for States, counties, and cities. The final figures for the three classes, which differed from the preliminary figures by only a few thousand in each case, were as follows: Totally unemployed, 5,833,401, emergency workers, 2,011,615, and partly unemployed, 3,219,502.

For the detailed tabulations, more than 13,000,000 cards were punched

and run at least seven times through the sorting and tabulating machines. The machine tabulation was completed early in April and the last copy for the reports will be sent to the printer about the middle of May. While this inquiry was not officially a Census Bureau inquiry, the work of tabulating the returns was handled by the Bureau for the Administrator of the "Census of Partial Employment, Unemployment, and Occupations." A maximum of about 1,750 persons were employed on this project at the peak of operations. Both the preliminary count and the final tabulations were completed in what is probably record time for an undertaking of such magnitude.

The detailed tabulations cover the following subjects for each of the three classes, so far as applicable. Color or race; sex; age; occupational groups; industry; residence (farm or non farm); number of hours worked "last week"—that is, the week preceding the registration; number of weeks worked "last year;" number of dependents; number of other workers in the family; and income "last week." Of special significance are the distributions by sex, age, occupation, and industry.

The results of these tabulations were given out first in a series of more than 400 press releases, followed by a series of State bulletins, with a summary for the United States. These bulletins will be assembled into volumes to form a part of the final reports.

There is also a volume giving the results of the so-called enumerative check, which was an actual enumeration of sample areas covering in the aggregate $1\frac{1}{2}$ per cent of the population of the United States. This enumeration not only served to give some idea of the completeness of the voluntary registration, but also furnished much supplementary information with respect to the classification of the unemployed and their relation to the fully employed, to the whole number of persons normally employed, and to the population as a whole.

SPECIAL TABULATION OF DEATHS

The division of Vital Statistics is compiling special tables showing the number of deaths from cancer, tuberculosis, and puerperal causes according to the place of death and place of residence for the year 1935. The work on this study, which is being done as a District of Columbia WPA project, involves the reallocation of non-resident deaths from these causes for every city and county in the United States. Final tables, to be published as Vital Statistics Special Reports, will show the number of deaths occurring in each area, the number of non-resident deaths, the number of deaths of residents occurring in other areas and the total number of resident deaths.

J. A. H.

STATISTICAL NEWS AND NOTES

Board of Governors of the Federal Reserve System

Statistics of international capital transactions of the United States for the full year 1937 were published in the *Federal Reserve Bulletin* for April 1938. The same issue contained, on an earlier page, a chart showing separately central bank balances and other foreign balances in the United States during 1937, excluding funds earmarked for the redemption of foreign securities held by Americans.

Federal Home Loan Bank Board

The compilation and publication of a series of building cost indexes and a series of estimated mortgage lending activity of savings and loan associations are being continued. The Federal Home Loan Bank Board is engaged in a study of the home mortgage financing and real estate operations of life insurance companies in the United States. This project includes the amount of non-farm home mortgages held by insurance companies, the volume of loans made during 1937, and real estate holdings and sales. It is expected that the study will be completed and available for circulation before the first of June.

In the near future a recapitulation of the consolidated annual reports of all member institutions of the Federal Home Loan Bank System will be prepared. This summary will contain by states and by type of association the dollar and percentage distribution of total assets and liabilities of all members of the System.

Bureau of Foreign and Domestic Commerce

Material which formerly appeared as Volume I of the *World Economic Review* was presented in the March issue of the *Survey of Current Business*, which has been designated as the Annual Review number. The issue was devoted to an analysis of economic trends in 1937 with the interrelations between the various elements in the economic system discussed with special emphasis given to maladjustments which developed late in 1936 and early in 1937. The various sections of the review are amply supported by charts and tables dealing with the more important business indicators. The June issue of the *Survey* carries the official estimates of the national income for 1937, while two articles of especial interest "Income of Independent Professional Practitioners" and "The Present Status of Fair Trade Laws" appeared in the April and May issues, respectively.

The 1938 *Supplement to the Survey of Current Business* will be released in July. This volume presents the statistical record of economic trends in the United States and in Canada by months for the years 1934 to 1937, inclusive, together with the monthly averages on annual indexes back to 1913 where available. Comprehensive notes on sources of the material and methods of compilation are also included.

A publication of major interest, the "Atlas of Wholesale Grocery Trading Areas" was recently issued by the Bureau. This report was compiled with the cooperation of the wholesale grocery trade, and is designed to present a true, realistic picture of the trading areas pertaining to the major centers of wholesale grocery distribution with a further purpose of presenting the latest pertinent market data which may be used to evaluate the various areas described. There is an increasing need for such information and this publication should be of assistance to research directors of advertising agencies and publishing houses, economists, and general students of wholesale distribution.

Beginning with January of this year "Retail Sales of Independent Firms in 25 States by Kinds of Business" has been currently presented in the 10th of the month issue of *Domestic Commerce*, a Bureau publication. Data are shown for 23 kinds of business and for city size groups, together with an analysis of current retail activity based on these and other sales data collected by the Bureau. For the past several years independent retail store sales have been collected by the Bureau and separate releases issued for each of the states covered. This service is now in operation in 26 states, and it is planned to expand it to include all of the states in the Nation as rapidly as possible. *Domestic Commerce* which appears on the 10th, 20th, and 30th of each month contains data on new Governmental studies of interest to business men, as well as information on research activities and marketing studies from non-governmental sources. A survey obtaining suggestions to make it still more valuable has recently been completed.

The 1938 edition of *Market Research Sources* which brings up to date the record of marketing research in the United States was released in May. All known available sources of research in this field have been included. This edition (the seventh) lists material published in the years 1933 to 1936, inclusive, and most of 1937, and includes a suggested list of periodicals with the addresses of the publishers. There are also listed in this volume all market studies which have been made by newspapers that have come to the attention of the Bureau of Foreign and Domestic Commerce.

The publication of a series of trade bulletins for individual countries has been inaugurated. These bulletins, the first of which appeared in February, give preliminary figures for 1937 on trade of the United States by commodities with leading foreign countries and bring up to date material in *Foreign Trade of the United States, calendar year 1936* which was released in April. Countries for which bulletins have already been issued are Belgium, Canada, China, Japan, Mexico, Netherlands, Union of South Socialist Republics, and the United Kingdom; bulletins in process of preparation include Argentina, Brazil, British South Africa, Chile, Cuba, France, Germany, Italy, and the Netherlands Indies. The annual *Summary of the United States Trade with the World* for 1937 is now available.

A publication which is due to make its appearance in the early summer is "Rubber Statistics, 1900-1937, Production, Absorption, Stocks, and Price." This pamphlet contains a great deal of basic statistical data necessary to a

study of the development of the rubber manufacturing industry and should prove useful to rubber manufacturers, importers, dealers, and others interested in the rubber trade.

Federal Trade Commission

By House Joint Resolution No. 594, approved by the President April 13, Congress has directed the Federal Trade Commission to investigate the policies employed by manufacturers in distributing motor vehicles, accessories and parts and the policies of dealers in selling motor vehicles at retail as these policies affect the public interest.

One of the purposes of the investigation, as stated by the Resolution, is to determine the extent of concentration or monopoly in the manufacturing, warehousing, distribution and sale of automobiles and of accessories and parts, prevailing in the industry. The Commission is also directed to investigate the methods and devices used by manufacturers in obtaining or maintaining such monopoly or concentration. Inquiry is to be made into all fraudulent, unfair and injurious methods, including price fixing and unfair trade practices, employed by members of the industry. Violations of the antitrust laws of the United States are included in the scope of the investigation.

The Commission is given one year from the date of enactment of the Resolution in which to make its report to Congress, which is to include recommendations for whatever remedial legislation it deems necessary and proper. The appropriation of \$50,000 is authorized by the Resolution for the purpose of making the investigation.

Department of Agriculture Graduate School

The Statistics seminar of the United States Department of Agriculture Graduate School has been meeting semi-monthly under the direction of Dr. W. E. Deming and Mr. A. Sturges as part of the official program of Government work. Recent speakers and their topics have been: Dr. R. G. D. Allen of London, "Difficulties in the Application of the Chi Square test to Economic Data," Mr. Lester Frankel, "Transformations to Achieve Normality of Frequency Distributions," Mr. A. Blake, "Theory of Least Squares from the viewpoint of Dr. E. H. Moore," and Dr. Chester I. Bliss, "Time Mortality Treatment."

Bureau of Agricultural Economics

Among the recent publications of the Bureau of Agricultural Economics have been "An Analysis of the Effects of the Processing Taxes Levied under the Agricultural Adjustment Act," "A Study of Factors Affecting the Price of Dry Edible Beans in the United States, by Classes," "The Preparation of Statistical Tables—A Handbook" (now in its second edition of 2,000 copies), and "Soybeans in the United States; Recent Trends and Present Economic Status."

Several changes have recently been made in the statistical work of the Bureau as the result of the work of the Bureau Statistics Committee in co-operation with various divisions in the Bureau. The most important change in organization has been to set up in the Division of Crop and Livestock Estimates a Marketing Statistics Section. This new section is now responsible for the cold storage reports and the transportation reports and also for several kinds of market data formerly gathered by some of the market news offices. The section was set up in order to provide for better coordination of marketing statistics now collected in the Bureau and in order to provide a more complete and adequate set of data on marketing.

A statistical pool is being set up in the Division of Statistical and Historical Research. This pool is to maintain a complete catalogue and index of all statistical series in the Bureau, and is to be prepared to answer any requests for statistical information made either by specialists within the Bureau or by outside parties. Some of the tabulation of statistical data is being transferred from the Division of Statistical and Historical Research to the market news sections of the commodity divisions and to the Foreign Agricultural Service Division.

Among the changes which have been made in the published data of the Bureau are the adoption of uniform definitions of marketing seasons for all agricultural products, the dropping of monthly reports of the condition of crops in most cases and the substitution of indicated yield per acre, and the changing of the former "intentions to plant" report into a report on "prospective plantings." This last change was made because the present reports are considerably more than a simple average of the intentions reported by farmers. These latter reports are used along with other statistical information to estimate as accurately as possible how much of each crop is likely to be planted.

The committee has recently been reviewing the statistical publications of the Bureau in considering changes which might make agricultural statistics more readily available or more easily understood. Any suggestions along this line from members of the American Statistical Association would be greatly appreciated by the Committee.

Social Security Board

Publication of a monthly bulletin reporting current operations under provisions of the Social Security Act was begun during March. The new *Social Security Bulletin* will carry regularly summary data showing, among other developments, current receipts and expenditures under all titles of the Social Security Act; total costs of public aid in the United States, including public assistance under the Social Security Act, earnings under the Works Program, general relief, and other forms of aid provided to persons in need from Federal, State, and local funds; estimates of the number of different households receiving one or more of these types of aid during each month, and of the number of individuals comprising these households; contributions received and benefits paid under State unemployment compensation laws;

payments under the Federal old-age insurance program; and other data which together afford a comprehensive record of developments in the field of social insurance and public assistance. Special articles and reports on research in the field of social security will also be published in the *Bulletin*. Articles in the first (March) issue include summaries of studies dealing with the economic status of the aged population of the United States; almshouse care and old-age assistance; the program for statistical reporting by State unemployment compensation agencies and the pay-roll report forms of these agencies; the estimated volume of employment covered by State unemployment compensation laws; an analysis of the effect of unemployment benefits on 2,500 relief cases in Philadelphia; and an article on "Social Security and the Social Services," by Arthur J. Altmeyer, Chairman of the Social Security Board. The *Bulletin* is prepared in the Bureau of Research and Statistics, and is on sale by the Superintendent of Documents, United States Government Printing Office.

The development of facilities for the prompt exchange of relief information among public relief agencies of large cities has been undertaken by the Division of Public Assistance Research of the Bureau of Research and Statistics, in response to the special request of administrators and statisticians in several cities. A subcommittee consisting of Ralph G. Hurlin, Chairman, Helen R. Jeter, Howard Myers, and Saya S. Schwartz, was appointed by the Joint Committee on Relief Statistics of the American Public Welfare Association and the American Statistical Association to advise the Bureau in this undertaking. Tabulations of data for January, February, and March have been mailed to cooperating cities and to State departments of public welfare. Summaries will be published from time to time in the *Social Security Bulletin*.

The Division of Public Assistance Research is undertaking a series of regional statistical conferences arranged through its field representatives in the twelve regional offices of the Board. The first of these, arranged by Anne Geddes in Boston on October 4 and 5, 1937, included relief and public welfare statisticians from the New England States. Ralph Hurlin, Director of Statistics of the Russell Sage Foundation, discussed the purpose and planning of statistical publications. The second conference, held near Birmingham, Alabama, on March 21-23, was conducted by Hallie Price, regional representative of the Division of Public Assistance Research. Statisticians from departments of public welfare in South Carolina, Alabama, Georgia, Mississippi, and Tennessee discussed the problems of collecting reports from counties, securing an unduplicated count of cases, the method of tabulating and analyzing social data about recipients, the planning of monthly statistical bulletins and special studies. The regional statistical conference arranged in Dallas, Texas, on March 24-26, by Earl Pemberton, representative of the Division in the San Antonio regional office, was the first attempt at joint conference between unemployment compensation statisticians and public welfare statisticians. Representatives from the State agencies administering public assistance and unemployment compensation

in Texas, New Mexico, and Louisiana presented papers on the uses of unemployment and public welfare statistics for public information and public relations, costs of various methods of presenting statistical reports, and the uses of statistics for operations control.

A manual covering a suggested method of conducting a case census has been completed by the Division of Public Assistance Research. When printed copies of the manual are available, it will be distributed to State departments of public welfare and to local agencies interested in conducting a case census. Such a census, however, will not form part of the statistical procedure required by the Social Security Board.

The first regular statistical reports on unemployment-benefit operations of the benefit-paying States were received during February and March by the Board. Data from these reports have been analyzed by the Division of Unemployment Compensation Research of the Bureau of Research and Statistics, and tables showing initial and continued claims received, and number and amount of benefit payments, have appeared in the *Social Security Bulletin*.

Memoranda have been prepared in the Division of Unemployment Compensation Research on the development of the Code for Industrial Classification used by State unemployment compensation agencies, on tips in relation to wages under the social security program, and on suggested methods for determination of seasonal employments in connection with administration of unemployment compensation laws.

A number of studies to determine sickness and disability rates in the United States are being undertaken by the Division of Health Studies of the Bureau of Research and Statistics. Disability experience in European countries, where social insurance against disability has made possible the accumulation of dependable statistics, is being summarized and analyzed. The foreign experience is also being applied to the population of the United States, with proper corrections and modifications for differences in age, sex, economic status, occupation, and other variables. In addition, available statistics on sickness and disablement in the United States are being brought together. Account is being taken of data accumulated through sickness surveys, the experience of retirement plans containing disability provisions, and experience in commercial insurance against sickness and disability.

A study of family composition in the United States is being made in Richmond by the Division of Health Studies, with the assistance of funds granted by the Works Progress Administration. The project involves detailed study of a sample of approximately 800,000 families from representative cities of 19 States, and from 23 rural counties. The data have become available through the schedules of the National Health Inventory recently conducted by the United States Public Health Service. The study is intended to provide a more accurate knowledge than has hitherto been available of the size and composition of American households and families.

Bureau of Labor Statistics

Four new bulletins have been issued by the Industrial Relations Division dealing with a review of strikes, 1880-1937 (Bulletin No. 651), union wages and hours, May 15, 1937, in the building and printing trades (Nos. 657 and 655), and characteristics of company unions, 1936 (No. 634). The April issue of the *Monthly Labor Review* carried a summary of the company union study. Analyses have been made of collective bargaining by the United Electrical, Radio, and Machine Workers of America, and of union agreements in the cement industry. A study of seniority provisions in union agreements is under way.

Employment and earnings of office employees in manufacturing establishments for January, June and December of 1935, June and December of 1936, and June and December of 1937 are shown in a study being completed. The Bureau's employment and payroll indexes for coal mining, year-round hotels, laundries, and dyeing and cleaning establishments have been revised to conform with the trend shown by the 1935 Census for these industries. The indexes for manufacturing industries are now being adjusted to the levels of the 1935 Census of Manufactures.

In September 1937, in conjunction with the regular monthly survey of employment, earnings and hours, data were secured for men and women employees separately among the important women-employing states and industries. The data were analyzed and released by the Women's Bureau. A similar survey was made in March, and will be continued semi-annually in September and March.

In the field of industrial injury statistics two special studies have recently been completed. One covers 70 industries in the year 1936, and presents injury rates for these industries by individual states. The other represents the first study of injuries to workers in the construction industry which has been undertaken by the Bureau, and covers also the year 1936. A number of articles based on the survey of workmen's compensation administration have been published in the *Monthly Labor Review* in advance of the complete bulletin; an article on "Claims Procedure and Administration" appeared in the *May Review*.

Wage and hour studies have recently been completed for the following industries: bituminous coal, cotton textiles, radio and phonograph, electrical machinery and apparatus, and explosives. Surveys are under way for furniture, soap, meat packing, fertilizers, woolen and worsted, and the dyeing and finishing of textiles. A preliminary report has been prepared on paid vacations in industry.

In the field of construction statistics, a project financed by WPA funds has been launched which will furnish information on (1) the volume of building prior to 1920; (2) residential construction, by cost groups and type of material, 1936-38; (3) number of dwellings erected in unincorporated areas within metropolitan districts of large cities, to be combined with regular reports of the Bureau as a basis of estimating total non-farm resi-

dential construction; (4) relationship between permit valuations and selling prices of dwellings.

A new bulletin (No. 650) presents a review of construction from 1921 to 1937, a detailed comparison of construction activity in 1936 and 1937, and a summary of the special building permit survey which covered the years 1929-1935. Over 100 individual city reports have been issued on the basis of this survey. "PWA and Industry" (Bulletin No. 658) shows the effect of PWA expenditures for different types of construction, analyzes the amount of labor created at the site, the amount of money spent for various materials, and the amount of labor created in fabricating materials. With the awarding of contracts by the Federal Housing Administration, the Bureau will collect data on employment, payrolls and hours worked under these contracts.

A special study of labor turnover in the slaughtering and meat packing industry in 1936 and 1937 has been made and another will soon be released on petroleum refining. In addition to the general turnover rates for all manufacturing, separate rates are now published monthly for 20 industries.

An extensive program is in progress for tabulating and analyzing retail price records to determine the adequacy of the data for use in the indexes of food and other cost of living items, and for the publication of average prices as such. Work is being completed on a history of retail food prices from 1890 to date, to include methods of price collection and the computation of average prices and indexes. A retail food price bulletin (No. 635) containing average prices and indexes from 1923 to 1936 has been issued.

The income distribution of native white families containing both husband and wife, as revealed by the urban survey of consumer purchases, was shown in an article in the March *Monthly Labor Review* for all cities included in the study. Mimeographed releases presenting also data on expenditure distributions of the same types of families are being issued for individual cities. Families within an income range of \$500-\$10,000 are included.

To meet the demand for a discussion of the methodology used in the construction of index numbers of wholesale prices of the Bureau, a reprint of Part I, Bulletin 284, "The Making and Using of Index Numbers" by Wesley C. Mitchell has been issued. The publication bears bulletin number 656, and single copies are available on request to the Bureau. For quantities of three or more, orders should be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. or to the Bureau of Labor Statistics.

The revised prices and index numbers for the farm machinery, soap, underwear, and boxboard industries were introduced with the computation of the January 1938 general index number. There are available upon request to the Bureau the following mimeographed publications: "Estimated Value in Exchange and Relative Importance of Commodities Included in Weighted Index Number of Wholesale Commodity Prices for the Year 1937," "Specifications of Commodities Entering Into the Composite Weighted Index (Revised)."

United States Employment Service

Tabulation work in connection with a detailed survey of all registrants in the active file of the United States Employment Service which was taken in field offices as of April 1 is now nearing completion. This survey, which is similar in form and content to five previous surveys, provides detailed information concerning the number, distribution and characteristics of all job-seekers in public employment offices throughout the country. Tables giving occupational and industrial classifications, age, education, and veteran status, with cross-classifications by sex and for each sex by color are provided by this study. Geographic breakdowns are prepared by states and within each state by counties or districts.

The active file of the Employment Service, upon which the records of this survey are prepared, is composed of all persons currently in active search of jobs through the facilities of the Employment Service. It includes the voluntary registration of all types of workers. Applications for all unemployment compensation claimants in benefit-paying states are included in the file, since registration with Employment Service offices is a prerequisite to receiving unemployment compensation benefits. At the present time there are twenty-five benefit-paying states and on July 1 three additional states are scheduled to begin payments.

Over six and three-quarter million registrations were included in the April inventory survey, approximately five and one-third million representing men.

To supplement the periodic complete national surveys of the active file covering all registrants, methods are being developed whereby indications of the distribution and characteristics of the active file can be secured through a representative sample. According to present indications it will be possible to secure a representative sample from the records of some ten selected states. The validity of such a sample is being carefully checked.

The Worker-Analysis Section of the United States Employment Service has finished the standardization of preliminary selection and classification techniques for several clerical occupations. These techniques are considered preliminary until thoroughly checked by follow-up studies. (The validity of the predictor batteries is represented by the following multiple correlation coefficients: Bookkeeping Machine Operators, .51; Calculating Machine Operators, .69; Comptometer Operators, .69; Hand Transcribers, .51.) In addition to studies of clerical workers, preliminary predictor batteries have been standardized for Lamp Shade Sewers and Power Sewing Machine Operators.

These experimental selection and classification techniques have been introduced into employment offices in approximately 40 cities during the period from November 1937 to April 1938. These techniques include typing, stenographic, and certain clerical tests, as well as standardized trade questions. There are now approximately 120 cities where various standardized techniques have been introduced into employment office procedure.

Women's Bureau, U. S. Department of Labor

A new series of reporting has been undertaken by the Women's Bureau to fill the need for some indication of the general direction of women's wages and employment. With the assistance of the Bureau of Labor Statistics and of various State labor departments, pay-roll information for a typical pay period in September 1937 was obtained on special forms sent out to the various cooperating manufacturing plants in connection with the regular reports furnished each month to the Bureau of Labor Statistics. The resulting material as compiled shows the average week's earnings, average hours of work, and average hourly earnings of some 500,000 women in 43 industries in the 12 large industrial States that employ three-fourths of the women in manufacturing. For the averages shown the data are weighted according to the relative importance of men and women in each industry. Similar reports are being requested for March and will again be asked for in September, 1938. The plants that can cooperate in furnishing these reports are those that have better organized pay rolls, and consequently the wages shown are higher than those found by an investigation of all types of plants in an industry; nevertheless they will constitute a basis for discovering, on a broad geographical and industrial base, the trend of women's wages from period to period.

The Bureau made a survey of women's wages and hours of work in Kentucky in late 1937 or in early 1938, and furnished supervision to assist the State labor department in Arizona in making such a survey as a basis for wage determination under the new Arizona minimum-wage law. The reports issued for Kentucky showed women's median week's earnings of \$13.70 in department stores (regular workers, not including part-time workers), \$13 in manufacturing plants, and \$9.05 in commercial laundries (\$9.10 for white, \$8.7 for Negro women). Nearly a fourth of the women in department stores and almost half those in limited-price stores were part-time workers. Wages were somewhat higher in Louisville than elsewhere in the State.

At the request of the Millinery Stabilization Commission, which was formed in 1935 by agreement between labor and employers at the suggestion of the Mayor of New York, the Women's Bureau is conducting a survey of the millinery industry in order to assist in improving the situation of the industry and its workers. This study will include information on fluctuations in employment, hours, earnings, and production during 1937, and also is considering variations among the different plants and areas in cost of production, receipts, and labor productivity. Methods of selling factory products will be examined, with the assistance of other government agencies.

During the past year the Bureau has made field investigations of wages in various men's clothing industries that are large employers of women, in order to assist the Public Contracts Board in determining fair minimum wages to be paid workers on goods for government purchase. The average week's earnings of the women reported ranged from \$9.90 in work-shirt factories to \$18.60 in the manufacture of neckwear. Other industries covered

were shoes, caps and hats, dress shirts, sportswear, raincoats, work gloves, knit underwear, cotton underwear, work clothes, handkerchiefs, and seamstress hosiery.

Division of Social Research, Works Progress Administration

Methodology of Regionalization and Subregionalization. The delineation of socio-economic regions and subregions for the rural-farm population of the United States has been undertaken to assist in the work of social planning and research. Based on the county as the unit, broad regions were delineated on the basis of major types of farming, a rural-farm plane of living index, an index of population fertility, and the percentage of farm tenancy. By means of these and additional indices such as percentage of farms producing less than a given amount of income in 1929, percentage of farm produce used on the farm, per capita land value, and per cent of the rural population engaged in farming, subregions are being differentiated. On the basis of careful statistical testing of variations in the indices from county to county, boundaries between regions and subregions are being fixed to represent a final approximation to socio-economic areas.

Net Number of Relief and Nonrelief Households. Estimates of the total unduplicated number of relief and nonrelief households and persons receiving relief, Works Program, and emergency employment each month from January 1933 to date, with a breakdown by agencies for the month of July of each year have recently been released. These estimates have been prepared jointly by the Division of Social Research and the Division of Research, Statistics and Records of the Works Progress Administration, and the Division of Public Assistance, Research, Social Security Board.*

Migratory Cotton-Pickers in the Southwest. Work is nearing completion on a study of migratory cotton-pickers in Arizona and New Mexico during the 1937 season. Some of the aspects of the situation which will be considered in the report are the nature of the demand for cotton-pickers, the effects of mechanization and concentration of land ownership, the origin and itineraries of the labor supply, methods used to recruit a large supply, wages, conditions of living, and health.

Standard Procedures. There are now available five standard procedures for operation of local research projects, issued for the purpose of developing comparable and useful State and local Works Progress Administration statistical projects. The procedures available are "Technique for Real Property Inventory," "Traffic Survey Manual," "Indexing Vital Statistics Certificates," "Compilation of Property Identification Maps," and "Index of Deeds, Mortgages, and Other Encumbrances." Eight other procedures are in process of preparation, and others related closely to the field of relief are planned.

Low Income Housing Area Surveys. A standard procedure on "Low Income Housing Area Surveys" is being prepared to develop local research projects which will assist the United States Housing Authority in the opera-

* See page 363.

tion of its program. The Federal Housing Administration and the United States Housing Authority are cooperating with the Division of Social Research in this work.

In order to locate appropriate areas for rehousing activities, information will be obtained on substandard conditions, family income, and rentals. The surveys will be conducted in areas found substandard according to Real Property Surveys. Real Property Surveys will be conducted in areas not previously covered. A great amount of local interest has developed in these surveys.

Analytic Index of Social Statistics. In order to fully utilize the great mass of statistics available in the field of relief and unemployment, a new type of card catalog, designed especially for statistical material, has been set up. By means of three-fold subject headings and a system of direct reference to individual tabulations, a reference unit has been established which will greatly facilitate the location of necessary data from a wide variety of sources.

Digest of State and Local Research Projects. Digests of State and local research projects carried on with relief funds are being prepared and planned for publication in one or more volumes in the next few months. The digests will be fully indexed for purposes of reference and will be a guide to the major findings of the great volume of projects conducted during the last few years.

Cooperative Plan of Rural Research. There is in preparation a detailed history of the Cooperative Plan of Rural Research, conducted by the Division of Social Research of the Works Progress Administration, in cooperation with the State Colleges of Agriculture. The report will include a summary of the research conducted in each State under the cooperative arrangement, brief statements of the methodology of the Federal surveys in which the States participated, and digests of the approximately 150 State publications and the Federal bulletins and monographs issued as a result of this cooperation.

Rural Youth, Their Situations and Prospects. Work is nearly completed on a general monograph concerning rural youth, which brings together from a wide variety of sources the results of field studies and the general literature in this field. Special attention is given to the programs of various governmental and nongovernmental agencies which provide services and opportunities for rural youth.

The Human Side of Destitution and Relief. Field work has been completed in Dubuque, Iowa, on a personal history study which is designed to supplement the mass of statistics available in the field of unemployment and relief. The study will provide an intimate story of individual experiences during the depression, will illustrate the great variety of stresses arising out of unemployment, and will show the personal adjustments made to the situations faced.

Age of WPA Workers. A bulletin on the age of Works Progress Administration workers is being prepared. The bulletin is largely an analysis of age

trends of Works Progress Administration workers during the 1½ year period between June 1936 and November 1937. At the end of the bulletin some of the more important available age distributions are presented for reference.

State Public Welfare Legislation. This study, which is now nearing completion, will make available the results of extensive legal research concerning public welfare legislation in the 48 States. The monograph will place particular emphasis on the laws providing for relief and public assistance, and on the agencies set up to administer such laws.

Publications of the WPA Division of Social Research. "The Costs of Living in 59 Cities," Research Monograph XII, by Margaret Loomis Stecker, has been received from the Government Printing Office and is now ready for general distribution. The printed edition includes charts, tables, and budget data omitted from the mimeographed edition previously released. By applying indices of living costs to data from this study on intercity differences in costs in March 1935, the Bureau of Labor Statistics has been able, for 31 of the 59 cities, to obtain an approximation of the intercity differences as of December 15, 1937.

"Effects of the Works Program on Rural Relief," Research Monograph XIII, by Rebecca Farnham and Irene Link, is now ready for distribution. The monograph describes the effects of the transfer, during the latter half of 1935, of needy cases from the rolls of the Federal Emergency Relief Administration to more specialized programs of assistance. Data were obtained for this study from records of 5,377 families who were dependent on relief during June 1935 and who were dropped from the relief rolls during the succeeding five months. These families lived in 71 rural counties in Montana, South Dakota, Wisconsin, Iowa, West Virginia, North Carolina, and Georgia.

Division of Research, Statistics and Records, Works Progress Administration

Works Program Statistics. The new reporting system, made effective in December 1937 when the responsibility for reporting was transferred from the Area Statistical Offices to the states, is now established on a working basis. State Statisticians have been approved for 38 states and in each of the other State Administrations a temporary designation has been made for someone to perform the functions of State Statisticians until a permanent appointment can be made.

The number and content of reports was considerably simplified when the state offices took over the responsibility for reporting. With this simplification many of the time series which had been established at the beginning of the WPA program had to be modified because of the difficulty of obtaining comparable data economically under the state reporting system. One of the most important items discontinued was the monthly series on the unduplicated number of persons employed by state and by county. It is essential for administrative purposes to have current figures on employment and the weekly series is much more readily available and well suited to this purpose.

Other changes have resulted in making certain data available quarterly instead of monthly and in making other data available only for the state as a whole instead of for individual counties.

Some additions have been made in the periodic reports previously outlined. These additions include a quarterly report of persons employed by occupational class; a report on labor turnover on WPA projects; a report of persons employed on NYA projects by type of work; and an analysis report on sponsors' contributions by type of material.

In addition to the regular reports, certain special tabulations have been carried out in the states. A study was made of Household Service Demonstration Center projects to provide data on the number of persons in training for domestic service, the number of persons placed after completion of training, and earnings received by these persons receiving jobs. Another study provided information on activities of NYA Resident Training projects, including costs of operation, employment, types of work activities, and types of courses studied.

Special tabulations or studies such as those mentioned above are supervised for the various operating divisions of the Federal Works Progress Administration by the Division of Research, Statistics, and Records. Procedures for obtaining the data are developed by the Division in collaboration with the individual State Statisticians who offer what technical assistance is necessary to the operating division which compiles the report in the state.

The inventory of physical accomplishments on WPA and NYA projects through October 1, 1937 has been completed and separate summaries have been prepared for all states. It is planned to make further analysis of some of the major items of work for certain counties throughout the country as requested by State Administrators.

Some preliminary data have been obtained from the tabulations being made from records formerly maintained in the Area Statistical Offices. These data indicate that over 7,000,000 different persons were employed on the Works Program from July 1935 through November 1937 including about 5,000,000 different persons who worked on projects operated by the Works Progress Administration. Further analyses of work histories of persons employed on the Works Program are in process.

Relief Statistics. Monthly estimates of the net number of households and persons receiving relief, Works Program employment and emergency employment have been issued in mimeographed form for the period January 1933 through January 1938. Separate releases have presented estimates for subsequent months. These estimates cover both those certified as in need of relief and non-relief personnel. Copies may be obtained from the Works Progress Administration. These estimates were prepared in cooperation with the Division of Social Research.

The monthly memorandum on the several Federal, State, and local relief activities prepared for the administrative use of WPA officials has been continued and a memorandum covering the month of February was issued in

April. A review of the year 1937 was contained in the memorandum for December which gave comparisons of annual relief expenditures for 1936 and 1937 for each State for the Works Program, National Youth Administration, the Civil Conservation Corps, the public assistance program of the Social Security Board, general relief, and the rural rehabilitation program of the Farm Security Administration.

Research. Work is under way interpreting unemployment in terms of family units. This study will bring together the various local censuses from which family data have been tabulated and will analyze the incidence of unemployment on family workers. A method of estimating the number of totally and partially unemployed families is explained and illustrated.

The construction of a price dispersion index has been undertaken. It involves the calculation, monthly and weekly, of the average deviation of various price indices from the All Commodities index. The basic data are the wholesale price series of the Bureau of Labor Statistics. The value of this measure seems to lie in its usefulness as an indicator of changes in economic activity. High price dispersion was, during the last decade, always associated with periods of recessions and low indices of dispersion with satisfactory employment, production, and profit conditions. Various tests of the significance of this measure are being prepared and the findings are to be written up.

National Research Project, Works Progress Administration. In March 1938 the Project published a *Summary of Findings to Date*, bringing together information available from reports hitherto published by the Project as well as preliminary material from studies now in preparation. In addition to the *Summary* the following reports have recently been issued: "Cigar Makers—After the Lay-Off," "Mechanical Changes in the Woolen and Worsted Industry, 1910 to 1936" (Summary, reprinted from *Monthly Labor Review*, January 1938), "Recent Trends in Employment and Unemployment in Philadelphia," and "Changes in Technology and Labor Requirements in Crop Production: Potatoes."

The following reports are in press:* "Fuel Efficiency in Cement Manufacture, 1909-1935," "Trends in Size and Production of the Aggregate Farm Enterprise, 1909-36," "Changes in Technology and Labor Requirements in Crop Production: Corn," "Changes in Technology and Labor Requirements in Crop Production: Cotton," "The Labor Force of the Philadelphia Radio Industry in 1936," "Philadelphia Weavers and Loom Fixers," and "Employment and Unemployment in Philadelphia in May 1936."

Office of Education

Cooperative Program on State School Records and Reports. In response to the resolution in December 1935 by the National Council of Chief State School Officers requesting the Office of Education to take such steps as were necessary to complete the study of uniform statistical reports of State school systems, to determine uniform procedures and definitions, and to assist the

* Some of the titles given below may be changed slightly before publication

State departments of education to set up uniform records, the following steps have been taken cooperatively:

During 1936, revised definitions of terms used were sent to the States for criticisms and suggestions as bases for further modifications.

Analyses were made of basic recording and reporting forms in use in States to determine the items of information being secured by the States through the forms used by teachers, principals, supervisors, local superintendents, and others in making their required reports.

Tentative report forms were prepared suggesting "blocks of information," based on items determined through analyses in which States seemed to be interested.

Visits were made by representatives from the Office of Education to State departments of education for personal conferences with staff members to determine the extent to which the States, (a) agreed with and planned to use definitions of terms as revised, and (b) were interested in securing the items of information, as revealed in check lists from States in 1935 and as determined by analyses.

During 1937, tabulations and summaries, made of findings revealed by the personal conferences with State department staff members, were used as bases for further modifications of definitions of terms used and to be used.

Preparation was made of, (a) lists of desirable items of information that, in terms of current practices within States and of indications by States in personal conferences the previous year, should be available to the respective States and their subdivisions, and (b) suggested forms for recording these desirable items of information at their sources and for reporting such items as were found to be progressively needed by teachers, principals, and local superintendents and by State departments of education.

Criticisms and suggestions made by representatives of States in five regional conferences served as bases for supplementing and modifying actions and decisions previously determined and also served as guides to the individual States in efforts to make such revisions in its system of recording and reporting school data as it found and may find necessary.

The Cooperative University Research Program has resulted in several bulletins which give primary or derived statistics. These are *Economic Status of College Alumni*, Bulletin, 1937, No. 10; *College Student Mortality*, Bulletin, 1937, No. 11; *Some Factors in the Adjustment of College Students*, Bulletin, 1937, No. 12; *Economic Status of Rural Teachers*, Bulletin, 1937, No. 13; *University Unit Costs*, Bulletin, 1937, No. 21; and *State School Taxes and State Funds for Education and Their Apportionment in Seven States, 1934-35*, Pamphlet No. 78.

The Biennial Survey of Education for 1934-36 (Bulletin, 1937, No. 2) is being issued this year. Chapters dealing with statistics of school systems are (a) Statistical Summary, (b) Statistics of State Schools, (c) Statistics of City Schools, (d) Statistics of Higher Education, (e) Statistics of Public School Libraries, and (f) Statistics of Special Schools and Classes for Exceptional Children.

Study of Cumulative Records. The cumulative record cards of 177 school systems have been studied with the view to discovering the better practices in this area. Upon the basis of this analysis and a consideration of the known principles of pupil growth blocks of information which cumulative records might cover have been evolved. The results of this study have been published as Bulletin, 1938, No. 3, *The Use and Nature of the Cumulative Record*.

Pamphlet No. 83, 1938, *Handbook for Compiling Age-Grade Progress Statistics*, has been developed to aid school systems in studying their promotion methods. By an analysis made through the use of the statistical forms presented schools can discover what general types of maladjustment of pupils are present. The evidence from such an analysis may be used in revamping promotion policies, and in reorganizing instructional units. Also leads are given for the study of the adjustment of individual pupils.

United States Public Health Service

In connection with the program of the National Cancer Institute, which was established by Congress in 1937, the U. S. Public Health Service is undertaking three statistical investigations of cancer. The first of these is a study of the trend in the mortality from cancer by age, sex, race, nativity, geographic area and site of the disease. This investigation is being conducted with the cooperation of the Division of Vital Statistics of the Bureau of the Census which is supplying unpublished material. An analysis will be made of the recorded mortality for each state from the date of admittance to the death registration area to 1936.

In addition to the analysis of the mortality records, a study has been initiated to determine the morbidity from cancer. A schedule is sent to every physician, hospital and clinic in selected areas throughout the country requesting certain information concerning all patients who were seen or treated for cancer during the calendar year 1937. Visits are made to every person, who does not return the schedule, in order to obtain a complete record of all cases of known cancer. This study has been completed in Atlanta, Ga. and is now under way in Cook County, Ill., Allegheny County, Pa. and Wayne County, Mich. It is contemplated that the work will be extended to additional cities in other parts of the country.

An intensive study of the social, economic and medical factors associated with the development of cancer, is being carried on in Memorial Hospital, New York City. A detailed life-history form, embodying the hypotheses of leading authorities, concerning the factors which predispose to cancer, has been prepared and is being filled out by personal interview of persons attending the clinic in Memorial Hospital. In addition to the information contained in this form, each patient is given a thorough physical examination. A similar procedure is followed for patients who do not have cancer in order to obtain a control group. A considerable amount of preliminary experimentation has been necessary in order to develop a valid and reliable method of taking personal history which can be analyzed statistically.

American Association of Schools of Social Work

The Social Science Division of the Rockefeller Foundation has made a grant to the American Association of Schools of Social Work for a three-year study of the present curricula and plans of schools of social work and changes required for meeting the new demands for trained personnel in the state and federal Social Security programs. The study will be directed by the Executive Committee of the Association which consists of Wilbur I. Newstetter, Western Reserve University, President of the Association and Chairman of the Executive Committee; Marion Hathway, University of Pittsburgh, Secretary-Treasurer; Arlien Johnson, University of Washington; Margaret Leal, New York School of Social Work; Alice Leahy Shea, University of Minnesota; R. Clyde White, University of Chicago; and Elizabeth Wisner, Tulane University. In the study consideration will be given in particular to training required for students going into case work, administration, statistics and research in the public social services. Effective June 1 Miss Hathway will become full-time Executive Secretary of the Association.

Brookings Institution

In *Income and Economic Progress*, published by the Brookings Institution in 1935, it was suggested that there is "one type of distributive reform which in our judgment outranks all others in its promise of attaining the goal we seek"—namely "the gradual but persistent revamping of price policy so as to pass on the benefits of technological progress and rising productivity to all the population in their role of consumers." In further development of this subject a volume on *Price Policies and Economic Progress* shortly to be issued, will deal on the one hand with the obstacles, and on the other with the nature and extent of the practical progress which has been made towards the realization of this objective.

A translation and adaptation of Siegfried von Ciriacy-Wantrup's *Agrarkrisen und Stockungsspannen* has been prepared by Charles O. Hardy, and will be published by the Institution within a few months. This book is a historical description and theoretical analysis of the long cycles of prices and production of the nineteenth and twentieth centuries, with special reference to agriculture. On May 20 and 21 an invitation conference on the long cycle, sponsored by the Social Science Research Council was held at the Brookings Institution. A preliminary draft of the translation was laid before the Conference for discussion.

Research Projects at Dun & Bradstreet, Inc.

Survey of Wholesalers' Operating Costs. Four wholesale trades are being covered: Liquor, Automotive Parts and Accessories, Dry Goods and Paint. No general broadcast invitation was extended to wholesalers' associations in connection with this Survey, since it was necessary to focus on the Business Trend Survey as large a part of the energy of the staff as possible. The analyses of these operating statements from wholesalers are expected to be

published some time during the summer. Because the type of analysis attempted experimentally last year was so well received, increased attention will be given to grouping the houses according to method of operation, as measured by major customer groups and important commodity lines in their sales volume.

These analyses will continue the breakdown tried experimentally last year, classifying concerns in three groups according to profit status: successful, survival and unprofitable. The successful concern is defined as one which is earning a rate of return on its net worth sufficient to attract additional capital. Survival concerns are the intermediate group earning less than a desirable return on net worth, but able to continue in business indefinitely while showing some profit.

Business Trend Survey. The preliminary report, giving trends of sales, inventories and receivables for over 100 lines of industry and trade was published in the March issue of *Dun's Review* and distributed widely in the form of a special reprint. The preliminary report included figures from over 17,000 concerns with an aggregate sales volume of more than \$11 billion. This was better than 10 per cent of the total business transactions in the general area of manufacturing and trade covered by the Survey.

The first two sections of the final report will appear in the May issue of *Dun's Review*. They will be based on usable returns from over 28,000 concerns (out of more than 42,000 received), and the aggregate sales volume reported by the sample will total over \$22 billion.

In building up the estimated sales and inventory figures for 1937 each industry has been given its proper census weight, both in the preliminary and final computations. In addition, the final computation attempts the experiment of weighting the trend percentages for each size of concern according to the census breakdown, within that trade. In the field of manufacturing, where no size breakdown is available from the census, estimates of the proportion of volume by size groups were compiled from Treasury income statistics and other sources.

Along with permitting dollar estimates of inventories at the end of 1937, and sales for the years 1936 and 1937, the Survey has yielded some unusually complete figures on credit policies and experience. It has been possible to estimate the cash credit and instalment breakdown by trades for 1935, 1936 and 1937 and to show the trends of credit policies from year to year, both by dollar volume and by number of concerns.

The two final sections, expected to follow in the June and July issues of *Dun's Review*, will deal with expenditures of business concerns for additions and improvements during the past two years, and case studies of the differences in business trends which appear to be related to the size of the concern.

Dividend Policies during the Depression. An analysis of the related profits-and-dividends performance of corporations during the depression and recovery period, 1929 to 1935, was presented in the April, 1938 issue of *Dun's Review*. The aim was to discover, not merely what profits did, or what

dividends did, but particularly what they did together as corporate fortunes sank and recovered during those tense and significant years.

Because the records of 348 identical corporations are traced over the 7-year period, the data tell an inside story of corporate behavior of which the usual aggregate computations give only occasional glimpses. Analysis was also possible of the profit-making abilities and dividend-paying propensities of the various industry groups and size classes. The picture is drawn from the confidential information submitted last year by several hundred corporations in connection with the Dun & Bradstreet study of the effects of the Undistributed Profits Tax.

National Bureau of Economic Research

At its meeting in December the Universities-National Bureau Committee, which initiated the cooperative program of the National Bureau in 1935, agreed that the results of the two-year experimental period amply justified the continuation of the program and pointed the way for its further development. They laid down two essentials for effective work: (1) A scheme of organization that will assure for the program the continuation of disinterested guidance and the widest possible collaboration and support. There must be some going concern that can sponsor projects and provide, when desirable, for the publication of reports. (2) A center with an adequate staff and equipment for conferences, the assembling and storage of research materials, and accommodation for collaborators from a distance. To fulfill the first of these requirements they recommended that the relationship between the University representatives and the National Bureau be made closer in order to increase the extent and effectiveness of University participation in the planning and conduct of the National Bureau's work. At their annual meeting on February 7 the Directors of the National Bureau accepted the recommendations of the Universities-National Bureau Committee that it become a committee of the National Bureau, to be called the Committee on Cooperative Research, and that three Directors by University Appointment be added to the Board.

The annual meeting of the Conference on Research in National Income and Wealth on April 1 and 2 was attended by more than 50 persons. The results accruing from the stimulation of work by individual students have been so valuable that it decided to continue this line of activity. A list of problems that seem to demand and be susceptible of treatment by individual students will be drawn up in the hope that persons competent and in a position to undertake analyses can be found.

The papers presented at the April meeting were: "Problems in Estimating National Income arising from Production by Government," by G. C. Means (National Resources Committee); "The Correction of Wealth and Income Estimate for Price Changes," by M. A. Copeland and E. M. Martin (Central Statistical Board); "On the Measurement of National Wealth," by Simon Kuznets; "Allocation of Benefits from Governmental Expenditures," by R. W. Nelson and Donald Jackson (Department of Agriculture).

Those presented at Atlantic City under the auspices of the American Economic and Statistical Associations were: "National Income, Savings, and Investment," by Gottfried Haberler (Harvard University); "Capital Gains in Income Theory and Taxation Policy," by W. W. Hewett and Roy Blough (University of Cincinnati); "The Distribution of Family Incomes as Revealed by the Financial Survey of Urban Housing," by D. L. Wickens.

These seven papers, together with the discussion to which they gave rise, will soon be submitted to the Directors of the National Bureau for publication as Volume II of *Studies in Income and Wealth*.

The tabulation of the Wisconsin income tax returns for 1936 is virtually completed. The State plans to publish the results in several volumes, the first of which is now in press. In Delaware complete tabulation of the individual income tax returns for 1936 has been started. Punching has been completed and it is hoped that the detailed tabulation will be finished by the end of the summer.

One of the more extensive enterprises contemplated for the future is a survey of the available data on the distribution of income and wealth by size among individuals and families. It is proposed to conduct this survey by requesting the people closely associated and familiar with the various bodies of data in this field to submit brief reports on the character of such data, these reports taking into consideration questions that will be submitted to the reporters by a special committee of the Conference appointed to conduct the survey. This committee may attempt to summarize the results of the survey and indicate, if possible, the standards that it would be desirable to maintain in the future in the collection of any information intended to bear upon the distribution of income and wealth by size.

The Executive Committee of the Conference for 1938-39 comprises: Simon Kuznets, Chairman, M. A. Copeland (Central Statistical Board), H. M. Groves (University of Wisconsin), M. W. Hewett (University of Cincinnati), Hildegard Kneeland (National Resources Committee), R. R. Nathan (United States Bureau of Foreign and Domestic Commerce), O. C. Stine, (United States Bureau of Agricultural Economics), Milton Friedman, Secretary.

The Conference on Price Research, meeting at "Hillside" on April 8 and 9, was attended by 30 persons. The Conference endorsed a proposal of the Executive Committee that standing committees be made responsible for the promotion of cooperative research in special fields—the coal industry, the relation of costs and prices, and the problems of price control. Joel Dean, of the Economics Department of the University of Indiana and recently of McKinsey, Wellington and Company, has been made Executive Secretary with special duties in connection with the work of standing committees on research. The Executive Committee for 1938-39 consists of: F. C. Mills, Chairman, Anne Bezanson (University of Pennsylvania), M. A. Copeland (Central Statistical Board), E. S. Mason (Harvard University), Henry Schultz (University of Chicago), O. C. Stine (Bureau of Agricultural Economics), Willard Thorp (Dun and Bradstreet), C. L. Lee, Secretary.

National Industrial Conference Board

In the field of personnel administration the Board has continued its studies of special questions primarily by use of the questionnaire method. Information received from nearly five hundred companies is tabulated in its study of "Curtailment, Lay-Off Policy and Seniority." Detailed tables show how curtailment was effected and its approximate extent. Separate figures are given for companies that have agreements in one form or another with labor unions and those that have not. A study of "Profit-Sharing Plans for Executives" reports the experience of upwards of one hundred companies. An extended tabular statement gives the essential features of 54 different plans. These plans vary with the type of persons who participate, the method of computing the share of the profits and the method of payment. A further publication in the *Studies in Personnel Policy* deals with "Assuring Employment or Income to Wage Earners—A Case Study." It deals with the details of seven active and four discontinued plans. Further studies in this field relating to health insurance, company public relations, and employee rating systems are under way.

The Board's study of "Differentials in Industrial Wages and Hours in the United States" is an exhaustive analysis of average weekly and average hourly earnings and average hours of work per week in the following industries: cotton, foundries and machine shops, furniture, lumber, printing, electricity, gas, and paper and pulp. Averages are computed for geographic regions and states, for population groups, and within each industry for specific occupations in the different geographic areas.

The Board has recently issued a compilation of "Current Wages in Manufacturing Industries in Foreign Countries" and is assembling the results of its regular monthly inquiries regarding the cost of living and employment, hours, and earnings in manufacturing industries for the period July 1936 to December 1937, to be published shortly.

The first fruits of the Board's study of conditions in Russia were published in a brief exposition of the "Purchasing Power of Wages in the Soviet Union," bringing hitherto unpublished information regarding retail prices in that country. Discussions of "American Enterprises—Number and Size," "Depression and Recovery in the United States and Canada," and an analysis of "The Farm Control Act of 1938" complete the list of publications recently issued. The Board is engaged in further studies of national income in the Nineteenth Century, the distribution of income by size classes, estimates of national wealth, and wholesale price changes.

CHAPTER ACTIVITIES

The Albany Chapter

A meeting of the Chapter was held on February 28, 1938, at the Candle Light Inn in Albany for dinner and program. Mr. F. J. Decker, President of the Chapter, presided. Thirty-nine members and guests were present. Dr. Theodore H. Brown, Professor of Business Statistics of the Graduate School of Business Administration, Harvard University, was the speaker. His topic was "The Business Man's Use of Statistical Methods."

The Austin, Texas Chapter

On October 28, 1937, the Chapter held its first meeting for the current year. A paper entitled "The Recent Stock Market Decline and Its Effect on Business" was read by Mr. J. E. Hodges, Instructor in Business Administration, The University of Texas. Mr. Hodges first reviewed the recovery forces in effect up through the early part of 1937. This was followed by a description of business and stock market activity from the first of 1937 through the sharp decline of the market on October 19. The probable causes of the rapid market decline were also discussed.

In conclusion, the speaker stated that business was beginning a serious decline which was gathering momentum and that the recession would likely continue until the fall of 1938. The long term outlook for business was held to be favorable but complete and sustained recovery could be achieved only by a revival of the long dormant building industry and a general increase in the standard of living of the average worker.

A paper entitled "Censuses of Motor Vehicle Traffic," presented by Dr. C. W. Vickery, Chief Statistician of the Texas Highway Planning Survey, was the chief item on the program of a meeting of the Austin Chapter held December 18, 1937.

Dr. Vickery discussed methods of sampling, as well as methods of statistical analysis, in use in the Texas Highway Planning Survey conducted by the Texas Highway Department, in cooperation with the United States Bureau of Public Roads.

Two fundamentally different sampling methods are being employed to determine the amount of use of the various roads and road systems in the State. One of these methods involves the counting and classification of vehicles as they pass designated stations on the highways. The other method involves the obtaining from a representative sample of motor vehicle owners a detailed description of the trips made by each over a period of a year. A third method, which is a hybrid of the two, involves the counting of all vehicles and the securing of brief interviews from a representative sample at certain stations on the county roads.

Methods used for the seasonal correction of traffic counts were presented. The patterns of seasonal variation are determined from control stations at which a number of seasonally spaced counts are secured. Composite indexes

are prepared from a group of similar stations and employed for the seasonal correction of counts secured at stations where only a single count is made. The possibility of constructing a traffic flow map for the State Highway System from the data secured by the interview method was discussed, as well as the possibility of estimating the Traffic Potential between any two points on the highway system. A method developed for the analysis of the hybrid type of survey known as Extensional Analysis was also discussed.

The Austin Chapter held its third meeting of the year on February 21, 1938. Dr. J. C. Dolley, Professor of Banking and Finance, The University of Texas, was the principal speaker. His address was entitled "A Statistical Study of Some of the Effects of Securities Exchange Regulation."

Dr. Dolley's discussion followed closely the outline of his paper entitled, "Government Regulation of Stock Trading," which was published in the *American Economic Review*, issue of March, 1938.

The purpose of this study was to determine the effect that government regulations have had upon the stock-trading volume and liquidity of the national security markets. The study was confined to the New York Stock Exchange.

Dr. Dolley discussed the extent of government regulation over stock trading, devoting particular attention to margin regulations, the recent trend in volume of stock trading and market continuity, and the trend in volume of stock-exchange member trading. He presented tables and graphs showing the average daily reported volume of stock transactions from January, 1934, through October, 1937, the average number of shares traded per point of change in the Dow-Jones average of 70 stock prices for the same months, the average number of shares traded per point of change in market price of nine active stocks for the month of May, 1934, 1935, 1936, and 1937, average spreads in bid-ask quotations on a sample of several common stocks for May, 1935, and May, 1937, and the trends in absolute and relative volumes of round-lot and odd-lot transactions initiated on the floor and off the floor by members of the exchange, by specialists and by odd-lot dealers, from June 22, 1935 to October 16, 1937.

Among the conclusions drawn by Dr. Dolley, it was stated that, "During the past two and one-half years, the New York Stock Exchange has become a markedly more discontinuous market for stocks. With a general trend toward declining trading volume, stock prices have shown an increasing tendency toward wider spreads from sale to sale and wider ranges in bid-ask quotations."

It was shown that trading both by the outside public and by stock-exchange members diminished noticeably in volume during the period studied, with member trading for own account declining relatively more than public trading, and with floor trading most affected. The volume of transactions initiated both by the outside public and by exchange members declined sharply following imposition of higher margin requirements, indicating that those regulations have had the greatest effect on trading volume.

Dr. Dolley pointed out that, "It would seem that of the traders who have retired partially or wholly to the side-lines, more are professionals than amateurs. In the long run, the market activities of the former group are more likely to keep prices in line with sound values than amateur trading which is based largely on chance information and which is more easily affected by mob psychology."

Dr. Dolley suggested that while government regulations have encouraged the small investor in common stocks, the declining speculative trade is resulting in a less continuous market and in correspondingly less liquid stocks. The markets have become less able to absorb heavy liquidation, and the danger of collapsing price declines have increased. It has become more difficult and expensive to raise new capital funds through the flotation of stock and bond issues, and business expansion has been retarded accordingly. It was suggested that modifications be effected where necessary so as to provide the desired protection to the public with a minimum of injury to the liquidity and efficiency of the security markets.

The Chicago Chapter

The program subject of the fourth meeting of the season, February 15, was *Public Utilities*. Dr. Paul J. Raver, Executive Officer of the Illinois Commerce Commission, discussed "Trends in Public Utility Regulation." In concluding his discussion of regulatory policies, Dr. Raver said he believed that public utility companies should cooperate with commissions in arriving at some agreed basis for rates; that insofar as government enters the field as a competitor, such competition should be reasonably conducted and with regard for the investment of private companies; and that commissions and utilities must realize that their first responsibility is to the consumer. An analysis of "Current Problems in Public Utility Valuation" was made by Dr. Willard J. Graham, Professor of Accounting at the University of Chicago. Professor Graham discussed various accounting phases of public utility valuation and rate making. Professor Wilber J. Katz, Professor of Law of the University of Chicago, commented briefly on some of the points brought out by the speakers, and there was general discussion from the floor on the various problems involved in determining a basis for rate making. The attendance at this meeting was 98.

"Problems of Economic Planning" constituted the topic for the meeting held April 12. Mr. George E. Putnam, consulting economist of Swift and Company, spoke on "The Background of Planning." After stating that economic planning is not new to the United States, he reviewed previous examples of government planning in this country. "The Prospects for Planning" were discussed by Professor Harry D. Gideonse, Associate Professor of Economics of the University of Chicago. Professor Gideonse was of the opinion that the present tendency among businessmen to form organized groups is one indication that free enterprise is on the way out. He felt that the future of planning was a question of the conditions of intellectual freedom and the values placed on them. The program concluded with comments

by Howard J. Stover, Statistician, The Farm Foundation, Chicago, and Professor Fred E. Clark, Director of the Graduate Division of the School of Commerce, Northwestern University.

The Cincinnati Chapter

At a meeting of the Chapter on March 10, 1938, H. Carl Frantz, Personnel Research Department, Procter and Gamble Company, discussed the mathematics of life insurance under the title of "Life Insurance: You Get What You Pay For." The following officers were elected: President, W. A. Baude, University of Cincinnati; Vice-President, Elmer B. Royer, Industrial Relations Department, Procter and Gamble Company; Secretary, Douglas E. Scates, Cincinnati Public Schools.

Edgar Z. Palmer of the Bureau of Business Research of the University of Kentucky spoke on "The Effect of the Flood upon the Employment and Payrolls in Kentucky" at a meeting of the Chapter on April 21.

The Cleveland Chapter

On February 28, Mr. Howard Whipple Green addressed the Business Statistics Section of the Cleveland Chapter on "An Analysis of Election Returns." The talk was based on a study which dealt particularly with welfare levies in Cuyahoga County. The trends in the results of successive elections were studied by precincts and the effect of various factors such as the size of the vote, and the submission of other issues were noted. Mr. Green used some very effective shaded maps to illustrate the talk.

On March 21, the Group was addressed by Mr. Weisman, columnist for the Cleveland *Plain Dealer*, on the current economic outlook. Mr. Weisman spoke largely on the subject of capital and its use at the present time, raising the question whether at present the world is using its capital at a more rapid rate than it is being produced.

The speaker stated that there has been only a small volume of new corporate security issues floated during the past five years. The blame has been placed by many on the Security Exchange Commission and on the tax laws. The opinion is widely held that there is a log jam in the capital markets waiting for favorable action on the part of Washington to be released. Mr. Weisman wonders whether the trouble in the capital markets is not more deepseated than is generally supposed, whether there is really a plethora of funds waiting for investment opportunities.

The speaker reviewed the source of new capital funds. There is, first, the capital created by the savings of small investors, which was such an important source of the capital raised in the pioneer days in this country. Savings by small investors have been discouraged by bank failures in the early part of this decade, by the fear of inflation, by low interest rates on savings accounts and by real estate losses. He states that the increase in savings accounts at mutual savings banks has been less than that which would have been created by the accumulated interest. The attitude is more generally to eat, drink and be merry.

The second source of new capital is corporate thrift. This has been discouraged by the excess profits tax, which has encouraged corporations to distribute too large a portion of their earnings in dividends. Corporate thrift was the basis of the tremendous growth of companies such as The Ford Motor Company.

The third source is capital under the control of wealthy individuals. High inheritance, capital gains and surtax rates have discouraged those individuals from investing their capital in productive enterprise. Instead, they buy tax-free government securities. Too large a portion of capital funds are invested in "trustee" securities.

Mr. Weisman spoke briefly of the railroads. It was stated that they have eaten up their substance. They have lived on the accumulations of previous generations. Their plant and equipment have deteriorated. The question was submitted whether during the past five years we have borrowed on the future and lived on past substance to create a temporary prosperity. If so, how far can we go to draw out this hiding capital?

Mr. Weisman is wary of short answers, but he thinks that favorable tax laws passed before the adjournment of Congress might prove to be a considerable help by autumn. He believes that we can experience no marked improvement in the economic situation until private capital flows in larger quantities into productive enterprise. Prosperity is not created by ordinary replacement demands. The expansion of old enterprises and the creation of new undertakings are necessary to the development of healthy economic conditions. He doubts that a new outpouring of federal funds would be a satisfactory substitute for an expansion in the investment of private capital in productive projects.

The Connecticut Chapter

The annual meeting of the Connecticut Chapter was held at the Faculty Club, New Haven, March 15, 1938. Professor Burton H. Camp of Wesleyan University spoke on "Small Sample Theory—Some Critical Remarks."

The following officers were elected: President, Dr. Dorothy S. Thomas, Director of Research in Social Sciences, Institute of Human Relations, Yale University; Vice-President, Professor Underhill Moore, Yale University; Secretary-Treasurer, Louis M. Nichols, Comptroller, G. E. Supply Corporation; Members of the Executive Committee, Professor Frank Shuttleworth, Institute of Human Relations, Yale University, and Mr. H. Daniel Darling, Research Assistant, Connecticut State Labor Department.

The Lehigh Valley Statistical Society

A highly successful dinner meeting of the society was held on February 16. Twenty-five men attended. Mr. Henry W. Van Pelt, director of the Bureau of Statistics of the Commonwealth of Pennsylvania, spoke on "Condensed Graphs for the Guidance of Management." He described the recent suggestions for plotting internal statistics in a simple, effective way for the use of department heads and higher executives. He singled out for detailed analysis

the variable budget and charts depicting breakeven points. Mr. Van Pelt expressed the opinion that, in the future, much more attention would be given to this kind of statistical analysis. Mr. Frank W. Ziegler, assistant to Mr. Van Pelt, and in direct charge of the Pennsylvania Census of Productive Industries, accompanied Mr. Van Pelt. He spoke briefly on the function of the Pennsylvania Census.

The New York District Chapter

A meeting of the New York District Chapter was held on March 1, 1938. The general topic was "Capital and the Security Market." F. Leslie Hayford of General Motors Corporation presided.

The first speaker was J. H. Riddle of the Bankers Trust Company who spoke on "Bank Capital and Credit Expansion." The argument which Mr. Riddle sought to develop concerned the influence, if any, of the volume of bank capital upon the expansion in bank credit. His studies led him to the conclusion that the actual level of the capital funds of domestic banks at no time had tended to limit to any noticeable degree the extent of the credits which they were willing to make available to business.

For years, it has been traditional among bankers to accept a ratio between bank deposits and capital funds of about 10 to 1, as a proper and conservative limit to the expansion of bank credit. Actually however, past banking experience has shown the ratio of deposits to capital usually remained far below this level. On June 30, 1937, the ratio was not higher than 6.7 to 1, and is now presumably even lower, due to the contraction in bank loans and deposits this winter. In fact, an expansion in domestic bank credit of nearly \$21,000,000,000 could be witnessed on the present volume of capital funds without exceeding the traditional limit of 10 to 1. Even if all of the capital provided by the Reconstruction Finance Corporation to the banks were deducted from total bank capital funds, the extent of domestic bank credit expansion that would be possible within the limits of a 10 to 1 ratio would still be \$15,000,000,000 above present levels.

Before the present century, while our American bank system was still relatively undeveloped, the ratio of credit to capital was extremely low. In the year 1874, total deposits outstanding were actually less than the banks' total capital funds. With an almost continuous rise in subsequent years in both deposits and the volume of bank credit, by 1900 the total of capital funds represented about 40% of total bank deposits, and by 1937 was down to only 13%. Expressed in the more usual way, the ratio of deposits to capital in 1937 had risen to more than $7\frac{1}{2}$ to 1, from a ratio of less than 1 to 1 in 1874. Of course in considering the whole question of the limitations on bank credit expansion, it might be useful to examine the relationship of capital funds not only to deposits but also to bank note issues as well, wherever banks in past decades had their own note issues in circulation. However, even a long term study of the ratio between bank deposits and bank notes combined and the size of capital funds will reveal the same steady downward trend in the amount of bank capital considered necessary to support the

banks' credit structure. But seldom was the volume of bank credit anywhere near as high relative to the size of capital funds as the traditional 10 to 1 ratio.

The dominant influence governing the expansion or contraction in bank credit is after all simply general business demand for loans. Fluctuations in the volume of bank credit are traceable mainly to spontaneous economic causes, having little connection with academic ratios of capital to deposits. The existing level of bank capital is as little responsible for changes in the volume of business loans as it is for the interest rate charged on these loans. If any proof is needed of the relative insignificance of bank capital as the determining factor in the growth or contraction of credit, it is clearly found in a study during 1937 of two groups of representative domestic banks; the one group at the start of the year having a high ratio of deposits to capital (i.e., operating on a "thin equity"), the other group having a low ratio. It might have been supposed that the group operating on the thinnest margin would have been inclined to reduce its deposits more rapidly during the deflationary period of 1937 when all bank deposits were contracting steadily. On the contrary, the statistical analysis revealed this group with relatively low capital funds experienced a *smaller* decline in total deposits than the group having relatively large capital funds. In seeking an explanation for this phenomenon, it would seem probable that the banks with more limited capital felt a greater necessity to secure as large an income as possible by the full employment of all available funds in loans and investments, as the only means of ultimately increasing their capital. In other words, in this instance limited capital proved a cause for *not* adopting conservative policies and curtailing the volume of credit in times of uncertainty and deflation. About the only safe generalization regarding the influence of the relative size of capital funds on banking policy is the statement that the lower the available capital, the higher the degree of risk the banks seem prepared to take.

To conclude: In the coming year we need not expect the extent of bank lending to be limited by the amount of bank capital nor fear that banks will be persuaded to curtail further their deposits due to low capital funds, so long as they still possess *excess reserves*. All important, indeed almost the sole balance sheet factor determining the probable future course of bank credit, is the volume of excess reserves. Any early rise in business demands for credit is not likely to cause a corresponding liquidation of bank investments. No important reduction in investments is likely until the Federal Government at last attempts to reduce significantly its present deficits and actually starts to retire some of its present outstanding obligations (which of course in large measure are in the hands of the banks).

The second speaker was James F. Hughes of Smith, Barney and Company who spoke on "Bank Credit as a Forecaster of Business Trends." Mr. Hughes has undertaken a long term analysis of the relationship between the volume of bank investments, and the condition of the security markets. Ten years ago, he had believed that the level of interest rates represented one of the important factors in forecasting coming security market trends. He had

also observed that the major part of bull markets was usually witnessed during the period that business was below normal; the major part of bear markets while business activity was above normal. The most logical explanation for this phenomenon appeared to be that in past decades the final stages of expanding business activity found credit demands on the banks at a maximum, thus encouraging a liquidation of funds invested in securities, i.e., a withdrawal of support from the security markets, in order to meet this rising demand for business loans. On the other hand, during periods when business was below normal, and demands for loans therefore at a minimum, an increasingly large volume of idle bank funds became available for investment in securities. However, the last decade has seen an apparent collapse in this old and well-established correlation between interest rates and the investment market on the one hand and business activity on the other.

In the depression of 1929-32 for the first time we saw a persistent drop in business activity below normal accompanied by a level of security values well below normal. Then came the New Deal with its unique economic philosophies to insure a complete upset of the old traditional relationship between interest rates and business trends. Thereafter, the level of interest rates seems to have been of little use as an indicator of business prospects. A substitute in banking statistics had to be found if possible. The fluctuations in the banks' investment account appear to be the answer. Most other bank figures studied only synchronize with business fluctuations—do not forecast changes in business trends. But a careful examination of the ups and downs of bank investments establishes them as an excellent forecaster of business trends. The year 1919 provides a good example. In May, 1919, a five year rise in the banks' investment account was noted, followed by a sharp drop to July 1921 amounting to \$1,700,000,000. This represented a decline in that relatively short space of time of nearly 35%. The actual peak in the stock market, it will be remembered, was November 1919. It is interesting to note that business loans of the banks in 1919 continued to rise for quite some time after the downturn in their investments, which started in May of that year. Again it may be observed that the significant turning point in the long up-trend in bank investments during the "20's," was witnessed in June 1928. There followed a sharp decline in investments, accompanied by a continued rise in loans, through to the latter part of 1929. And lastly, it is a matter of note that a significant down-turn in bank investments, before our most recent market collapse, had already begun before the end of 1936. In the four major security market collapses of the 20th century, i.e. 1907, 1919, 1929, 1937, we were well forewarned by the same sequence of events, a down-turn in bank investments accompanied by a continued rise in loans for many months thereafter. Preceding the last collapse, that of 1937, we witnessed the greatest liquidation in bank investments in history, a drop of \$2,200,000,000, while during a major part of this liquidation business loans were still rising.

Thus, the course of bank investments has furnished conclusive signals to past bear markets. The value of such studies in timing bull markets is some-

what obscured by the generally upward long-term trend in bank investments. There have been periods when a rise in bank investments for some months has not signalled any important advance in the security markets. However, a careful examination of changes in bank investments has proved profitable in the study of bull markets as well.

The third speaker was Donald Woodward of Moody's Investor Service. His subject was "Some Problems of Capital Financing." One of the important considerations in studying the economic developments of the past five years has undoubtedly been the financing of gross capital formation by business. During this period from 1932 through 1936, the principal source of such capital financing was the working capital of corporations themselves. The liquid reserves of our major corporations were drawn on heavily not only for the purpose of reducing bank loans and floating indebtedness, but also for financing additions to capital assets, i.e., plant and equipment. Despite a sharp rise in these years in capital outlays, funds from the capital markets were either unnecessary or inaccessible to most corporations. So severe was the resulting drain on corporate funds that the working capital and cash position of domestic industry at the end of 1936 was the lowest in more than a decade. This method of financing was obviously economically unsatisfactory. Moreover it has led to a condition where resort to a properly functioning capital market is essential if any significant further improvement in capital outlays by business—which means normal activity in the durable goods industries—is to be witnessed in the coming years.

What are the usual sources of supply upon which the capital markets depend? They may be identified briefly as either individual domestic savings, importations of foreign capital, direct bank credit, or in more recent years particularly, government credit. To what extent has the total volume of funds available to the capital markets been affected by economic developments in the last five years? The quantity of individual savings does not appear to have been noticeably impaired. But a sharp curtailment has been experienced in the influx of foreign capital, which promises to remain restricted for some time, and in the volume of corporate savings, where further accumulations are now discouraged by the undistributed profits tax. Government credit remains an important but uncertain factor. Therefore, bank credit, as a source of capital financing has become in the past twenty years an increasingly important factor in influencing the conditions of capital formation and the status of the investment markets.

How adequate then are these banking resources likely to prove in making possible the necessary capital financing of domestic industry in coming years. Doubt is expressed that the present size of capital funds will *not* prove a somewhat limiting factor in the future expansion of bank credit, if for no other than psychological reasons, partly induced by the recent marked instability shown by bond prices. There may be little evident change in the total *quantity* of bank credit now available but there has been a real change in the recent years in the *quality*, or character, of bank credit available which will serve to restrict future expansion. In this regard, attention is called to

the increasing institutionalization of savings funds in this country, i.e., the passing of control of savings from private individuals into the hands of insurance companies, trust funds, investment trusts, etc. Characteristically institutional investors will hazard less in financing industrial developments than private investors. Moreover there has been a steady trend toward other restrictive government regulation over the operations of these savings institutions which also serves to curtail qualitatively their lending capacity. Also the extremely high present level of the bond market, unwisely supported by the extreme easy money policies of the government, will undoubtedly tend to discourage rapid expansion in bank credit from here on. The possible depreciation in principal value to which new investments at these high market levels are exposed is a very real hazard to the average banker.

The above considerations lead inevitably to the conclusion that the essential expansion in the capital markets so necessary to financing any important further increase in capital goods outlays is likely to be restricted by many factors. There appears to have been a real curtailment in the total available capital funds qualitatively if not quantitatively, which will play an important role in future financial developments. This curtailment may not necessarily serve to obstruct an early recovery in business activity from the existing extremely depressed levels, but after a more normal level of activity has been restored, its restrictive effect may become much more noticeable.

The final speaker was Ragnar D. Naess of the Tri-Continental Corporation who discussed "The Flow of Capital and the Security Market." He expressed a recognition of the basic importance of the capital markets to business development, the rate of reinvestment of savings funds as a controlling influence on business prosperity. It is clearly evident that until recently business expansion had been far less dependent upon funds from capital markets than is now the case with corporate working capital so greatly impaired. Yet the opportunity for securing an adequate supply of capital funds from a freely functioning security market is more limited than ever before. The capital market is hemmed in with government interferences while artificially easy money, without any active demand for money, has been created by the government's financial policies. The 1933-1936 business recovery was engineered by the triple government barrage of: (1) devaluation, (2) N.R.A. monopolistic controls, and (3) Government spending. The inevitable result was an excessive, artificial demand in the consumers goods industries. The subsequent expansion in the durable goods industries was long delayed and was made possible only through the exhaustion of corporate working capital. Today, therefore, we are faced with still high inventories, depleted cash reserves, and withdrawal by the government from its earlier inflationary policies on which business recovery was largely based. With this background, there is no clear prospect of any material improvement for at least six months in either the capital markets or general business activity.

CHARLES B. LOCKWOOD

The Philadelphia Chapter

A meeting of the Philadelphia Chapter was held on March 18, 1938 at the Manufacturers' and Bankers' Club in Philadelphia. Dr. Simon Kuznets of the National Bureau of Economic Research and the University of Pennsylvania spoke on "The Measurement of Capital Formation" and Dr. Gerhard Colm of the New School of Social Research discussed "Capital Formation and Taxation."

The Pittsburgh Chapter

The February meeting of the Pittsburgh Chapter was devoted to a discussion of the problems associated with the computation of local electric and telephone rates. This discussion was led by R. E. Caywood, Rate Engineer, West Penn Power Company, and E. W. Ortolf, Rate Engineer, Bell Telephone Company of Pennsylvania. The presentation was followed by considerable discussion as to the nature of local conditions which govern utility rate structures. The way in which the topography of Allegheny County exercises a very decisive factor in the determination of gas and electric rates was explained. Mr. Ortolf emphasized the experimentation with the local demand for telephone service which enters into the empirical determination of telephone rates.

"Some Thoughts About Industrial Development" was the topic for the March meeting. The discussion was led by Mr. Walter H. Kelley, Manager of the Industrial Development Department of the West Penn Power Company. Emphasis was placed upon the fact that the primary need of industry today was the agreement upon some stable program.

The San Francisco Chapter

Professor N. J. Silberling, Graduate School of Business of Stanford University, addressed the Chapter at a meeting on January 20, 1938 on the "Outlook for Housing Construction and Its Financing Aspect." He pointed out that the importance of housing construction as a factor in the general economic situation has not been sufficiently recognized nor has it been observed with an adequate background of statistical information. The building industry as a whole (of which housing construction is a large part) is the most important single factor in the major fluctuations of the business cycle. Many major factors impinge upon the building industry from without, such as war, inflation, and population movements. The effects of these external factors are often continued over a period of years.

Citing Rigglesman's index numbers, Professor Silberling traced the tremendous fluctuations which have occurred during the last century, all with their effects on manufacturing and extractive industries.

Roughly half of the American population lives in houses owned by their occupants but a Federal survey of 52 cities in 1934 showed that 58 per cent of the owner occupied homes were mortgaged. The 17 billion dollars of mortgage debt is the largest single classification of long-term debt in this country and equals the combined long-term debt of all railways and industrial

concerns. There is a great lack of statistical information about the financing of building. Construction is highly speculative and a good many of the financial troubles have their origin in the conditions surrounding the initial construction of structures. Lending institutions have been very conservative with the result that would-be home owners have sought second and third mortgages. Efforts are now being made to eliminate second and third mortgages and to insure mortgages. Careful supervision of the whole process is necessary for sound financing. There is also a tendency toward housing construction on a big scale. Recognition on the part of the investor-builder of the fact that most people are and always will be renters, will foster a policy of substantial building to provide permanent homes without waves of foreclosure and violent alternatives of employment and unemployment.

Dr. Evelyn Aylesworth, Supervision Statistician, California Forest and Range Experiment Station at Berkeley, spoke to the Chapter on "Dr. R. A. Fisher's Approach in Statistical Methodology" at its meeting on March 3, 1938. Following the development of the subject from Dr. Fisher's *Design of Experiment* but with additional examples from her own observations, the speaker outlined the logical principles of experimentation and discussed the design of experiments which satisfy these logical principles. The necessity of designing an experiment so that it will yield a valid test of significance, the desirability of replication, the use of experimental controls and randomization were discussed. Among the experimental devices which were considered in detail were pairing, grouping, factorial design and confounding.

The Washington Statistical Society

A meeting of the Washington Statistical Society was held on February 28, 1938 to discuss the desirability of revising the base periods for government index numbers. A summary of the discussion is presented as a separate note on page 411 of this issue of the JOURNAL.

The Chapter met on March 29, 1938 for a program of discussion on "Key Factors in the Current Business Situation." The principal participants were Ernest M. Fisher of the Federal Housing Administration, R. W. Goldschmidt of the Securities and Exchange Commission, Chandler Morse of the Board of Governors of the Federal Reserve System, Robert Nathan of the Bureau of Foreign and Domestic Commerce, and F. L. Thomsen of the Bureau of Agricultural Economics.

The annual meeting of the Chapter was held on April 26, 1938. The following officers were elected: President, Halbert L. Dunn, Bureau of the Census; Vice-President, O. E. Kiessling, Bureau of Mines; Secretary-Treasurer, Thomas B. Rhodes, Works Progress Administration. The subject for the evening's discussion was "Are We Progressing Toward a Standardized Concept of National Income?" A. D. H. Kaplan of the United States Bureau of Labor Statistics presided. The principal speakers were Robert G. Martin of the National Industrial Conference Board, Maurice Leven of the Brookings Institution and Hildegard Kneeland of the National Resources Committee.

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BOOK REVIEWS

RALPH J. WATKINS
Review Editor

The National Capital and Other Statistical Studies, by Sir Josiah Stamp. London: P. S. King & Son, Ltd. 1937. vii, 299 pp. 10s. 6d.

The eight chapters of this volume are eight addresses and articles dealing with various phases of the question of national wealth and national income, revised and brought down to date by their author, Sir Josiah Stamp. Like Sir Josiah's many earlier publications, these investigations are "purely statistical" in character—concerned primarily with "examining the facts" and presenting the resulting statistical measurements and conclusions in as colorless and dispassionate a way as possible. Thus, for the most part, they leave to others the specific application of the results to current social and economic problems.

In the first chapter, "The National Capital, 1928 and 1935," the author calculates Britain's national wealth in 1935 as 21.5 billion pounds sterling, and in 1928 as roughly 18.2 billions, compared with 14.3 billions in 1914. In commenting on these figures, and on the pitfalls and difficulties encountered in the calculation and interpretation of such estimates, he notes that, despite the apparent increase in wealth, Britain in 1935 had not recovered to the profit-earning, or income-making, level of 1928. There had been merely a change in the description of the country's wealth. Chapter VII, "The Economic Distribution of the National Capital," gives percentage distributions of Britain's national wealth by broad classes in 1892, 1913 or '14, and 1928. Comparisons over a more limited range are also given from the Census of Production for the years 1907, 1920, and 1924.

Chapters II and VIII consider the relationship of profits to prices and to certain other economic series. The importance of profits "in the economic machine" is pointed out as follows:

If individuals or a group find that they can associate a mass of accumulated capital or savings with a mass of human labour, manual and mental, and produce commodities or services which can be marketed at a figure that allows a margin above the rewards necessary to evoke the supply of the agents they bring together, then they will proceed, and employment results. If they can see no margin, and cannot, in prospect, cover their costs, no employment results. . . . No amount of bureaucratic planning can in the long run overcome the necessity for producing such a surplus for a wide range of products taken together (pages 45-46).

The chapters in question, however, are not concerned directly with a consideration of this thesis. Their purpose is the construction of an index of profits and a statistical analysis measuring the correlation of this index with various British indexes of production, prices, and trade activity, and with an American index of profits—account having been taken of the problem of trend.

Chapter III takes up the problems faced by the income statistician and summarizes the methodology and statistical material utilized in estimating the national income of many countries. Reference is made to the controversial issues involved in differences of definition, to the principal supporters of opposing views, and to the arguments by which the latter defend their respective positions.

In Chapter IV an ingenious technique is utilized for measuring the influence of changing price levels on incomes. Here the conclusion is reached that "the very rich gain relatively in income with a high price level, and lose relatively with a low, their income being highly sensitive to the effects of such changes."

Finally, Chapters V and VI deal with inheritance and the use of alcohol as economic factors influencing the production and distribution of wealth and income.

The book represents a timely addition to the literature of the field and to the author's earlier works—being of particular value in connection with his *Current Problems in Finance and Government*, *Wealth and Taxable Capacity*, and *British Incomes and Property*. Its application to practical problems of the day is assured by its author's intimate understanding of taxation, national debt, and related questions—gained through his long service on British and international boards of inquiry and commissions.

CLEONA LEWIS

Brookings Institution
Washington, D. C.

Wages and Income in the United Kingdom since 1860, by A. L. Bowley. Cambridge: at the University Press. New York: The Macmillan Company. 1937. xix, 151 pp. \$2.50.

This book presents a compact summary of Professor Bowley's studies on the subject of wages and their share in the national income in the United Kingdom. Utilizing largely his own writings, which date back to 1895 and cover the period since 1880, revising them at points where such revision can easily be made in the light of recent data, and supplementing them by a few references to other studies, the author discusses briefly money wages, real wages, some aspects of the distribution of earnings, the relation of earnings to needs, the total wage bill, and the share of total wages in the national income. Six appendices present some of the more technical aspects of the measures. An extensive bibliography of the author's writings, supplemented by a brief bibliography of the more important studies by other authors, provides references to the statistical groundwork of the summary estimates discussed in the text.

The estimates refer largely to the period from 1880 to the World War, a few measures are provided for the years back to 1860, and a great deal of

scattered information for the postwar years. The broad features of the long-time changes which these measures reveal are of great interest. Per capita money wages rose from about 59 in 1860 (1914 = 100) to 100 in 1914 and to about 187 in 1930-36. The more significant index of per capita real wages rose from 51 in 1860 to 100 in 1914 and to 129 in 1936. Although the data on the distribution of earnings by size are inconclusive, they tend to suggest for the prewar period a constancy in the relative range as measured by the extreme deciles or the first and third quartiles. The comparison of earnings with needs, based on rather fragmentary data, indicates a significant improvement in the position of wage-earning classes, reflected in a decline in the proportion of families below the poverty line. The total national wage bill showed a greater increase than per capita wages, owing to the increase in the number of wage earners; but this upward trend was damped by increasing unemployment, the index for employment showing a decline from 94.4 for the decade 1880-89 (1914 = 100) to an average of 82.2 for the period 1930-36. In the prewar years, for which comparable data are available, real wages per wage earner rose from 1880 to 1913 as much as did real income per occupied person; but both of these indexes showed a somewhat smaller rise than income per head of population, because of the growing ratio of the occupied population to the total population. Finally, "there was no important change in the proportion of earned to total income between 1880 and 1913 or between 1911, 1913 and 1924 . . ." (p. 97). The suggested stability in the share of wages in the national income appears to hold after 1924 as well.

The above is but a brief summary of the more outstanding conclusions. They are qualified in the discussion and amplified by indication of variations over the different periods in the rate at which the tendencies observed have manifested themselves. The conclusions provide valuable material for anyone interested in the secular movements in wages and the distribution of the national income among functional categories, and suggest a number of significant problems calling for further exploration. Thus, one important conclusion on which Professor Bowley lays stress—the stability of the share of wages in the national income—raises interesting questions as to the mechanism by which such stability was obtained. As the author points out: "It is remarkable that we get very nearly the same percentage, 40 to 43, according to the definition of income, from 1880, or even from 1860, to 1935 . . ." and "this approximate constancy is the more remarkable in view of the fact that the manual-labour class has formed a proportion of the occupied population that has diminished since 1880" (p. xvi). Such stability would not presumably be observed in the share of wages in the income originating in the various industries in the United Kingdom, and the crude data for the United States suggest that in this country no such stability was observed over similar periods even for the national economy as a whole (the information, however, is available only for the combined share of wages and salaries). The problem of why and how such stability was attained in

the United Kingdom is one that would repay study by statisticians, historians, and economists.

In conclusion one should note the admirable soberness and caution of Professor Bowley's treatment, his awareness of the pitfalls of the data and of the manifold aspects of the questions upon which the data shed light, and the dry humor and pithiness of some of his comments. These characteristics make the reading of this compact volume not only a profitable but also a pleasant task.

SIMON KUZNETS

National Bureau of
Economic Research

Personal Income Taxation, by Henry C. Simons. Chicago: University of Chicago Press. 1938. xi, 238 pp. \$2.00.

The author presents an analysis of numerous definitions of income for taxation and advances proposals for reforms in keeping with his definition of income and his theories of taxation. The greatest confusion is found among economists, with but few exceptions, in their definitions of income. Professor Simons declares that income "connotes, broadly, the exercise of control over the use of society's scarce resources." It is "the algebraic sum of (1) the market value of rights exercised in consumption and (2) the change in the value of the store of property rights between the beginning and the end of the fiscal period." He states, again, "the appropriate general conception of income for purposes of personal taxation may be defined as the algebraic sum of the individual's consumption expense and accumulation during the accounting period." He finds his definition of income similar to the definitions of Schanz and Haig. He rejects the well-known concept of Fisher that relates income to consumption but which excludes changes in capital.

The author regards the mitigation of inequality in the distribution of income as an essential purpose of taxation. Toward this end he favors progressive personal income taxation. Taxes on persons should occupy a major position in the tax system, while taxes on things should be of minor importance. Personal income taxation would be substituted for various commodity and payroll taxes. The following proposals would be incorporated in a general tax on personal incomes: (1) Exemptions of receipts by kind would be eliminated, (2) income in kind from the more durable types of consumer capital used by owners would be included in taxable income, (3) gifts, inheritances, and bequests would be counted as part of the recipient's income in the year received, and be subject to a supplementary personal tax in a cumulative form, (4) gains on assets that have appreciated in the owner's possession would be taxed at the time of sale and realized losses would be fully deductible, (5) income taxes would be adjusted for average income over five years, under certain conditions, (6) the tax rates on the lower in-

come brackets would be sharply increased and begin at 20 per cent, and (7) receipts from the normal tax would be shared with the states.

Professor Simons has contributed a logical and thought-provoking essay. As he himself admits, however, his definition of income for personal taxation would involve some complications and require arbitrary decisions in its application. The same criticism, of course, may be directed against any definition of income for taxation. The proper treatment of capital gains and losses, gifts, bequests, and inheritances must remain a matter of opinion for the present at least. Although there is merit in the author's proposal to combine income and death taxes, the proposal raises serious questions that are not easily brushed aside. The author's reform program must be considered not only in the light of his definition of income but also with respect to his plan to lessen inequality by taxation. How far shall we go?

ALFRED G. BUEHLER

University of Pennsylvania

Socialism versus Capitalism, by A. C. Pigou, New York and London: Macmillan & Co, Ltd. 1937. vii, pp. 139 \$1.75.

The allocation of productive resources to the various industries; incentives to work, management, and invention; and technical efficiency in relation to profit are old topics in the literature of the economics of socialism. They have seldom been considered, however, by a competent economic theorist from the standpoint of the fundamental ideal of social economy. That ideal is expressed, or reflected, in the theory of general economic equilibrium, in which the productivity of any productive resource is quantitatively the same in all its various applications. Under capitalism, theoretical ideal equilibrium, in which every factor is used where (in the sheer economic sense) it will do the most good, is attainable only under free competition and complete mobility of all factors. Similarly, theoretically perfect economy under socialism could be attained only through perfect, centralized planning. Since, in the complexities of actual life, there can be neither perfect competition nor perfect planning, the relative merits of capitalism and socialism can be judged only pragmatically, on the basis of the ways theoretically open to each form of economy to approximate the economic ideal and the probabilities that these ways will be followed, so far as conflicting interests, limited knowledge, and the extreme complexity of the practical problems involved permit.

This is the theoretical background of Professor Pigou's discussion, although in stating it in such highly generalized terms undue liberty is perhaps taken with Pigou's thought. The background, *in extenso*, is to be found in his *Economics of Welfare*.

Naturally, in so small a book, written for the general reader, the author cannot touch on all of the issues between socialism and capitalism or deal exhaustively with those he does discuss—even though he confines himself to

economic issues and refrains from entering on moral issues, such as freedom versus authority, which now loom larger in the public mind than do strictly economic considerations. Within the limits he sets, Professor Pigou's thought is thoroughly well balanced, eminently fair, and free from the emotional tone and addiction to ideology which impair the value of most of the literature in this field.

Some readers may think that in his desire to simplify and to consider only fundamentals Professor Pigou has in certain places oversimplified, by unduly drastic assumptions, and consequently left the balancing of the relative potentialities of capitalism and socialism too far removed from reality to gain the attention or understanding of the reader not inured to the logical devices of deductive theory. Nevertheless, except perhaps in the chapter on interest rates, he succeeds, as only a master of his subject can, in bringing the essential issues involved in difficult and intricate relations out into high light where even the uninstructed reader should see their significance.

On most counts Professor Pigou finds, on balance, some net advantage of socialism over capitalism, though in some cases it is slight and tentative. Assuming that the state will take over productive resources not by confiscation but by purchase, he concludes that there need be no fear as to the effect, direct or indirect, of socialism on capital formation, and that "the case for socialism as a remedy for inequalities of distribution among persons is much stronger than, at one stage of our discussion, it seemed to be." One chapter deals with the obstacles to "appropriate" or "ideal" distribution of productive resources in our actual capitalism; another with the allocation of such resources through the centralized planning which he assumes in his definition of socialism. He finds valid reason for extending the range of socialization (government ownership and operation) within the general framework of capitalism but cautions that this is not the same as substituting general socialism for the present system. The function of the central planning authority in socialism would be, through a trial-and-error process, to approximate the ideal equilibrium of economic theory, as nearly as complexities and uncertainties permit. He concludes that "the practical task . . . would be one of quite appalling difficulty, and one in which complete success is altogether out of the question," and hence that "except in a world of supermen . . . in any country where socialism as an ideal is being weighed against capitalism as a fact this truth . . . constitutes an argument against change."

On the other hand, in the handling of the unemployment problem socialism, with centralized planning, would have definite advantages over capitalism. In the distribution of consumption goods, presumably on basis of cost, in the allocation of productive factors, and in the provision for investment, it would be necessary for socialism to have an accounting system in monetary terms ("proper" relative prices to be approximated by trial and error or a series of "step by step adjustments"). An accounting rate of interest must be set up—a rate at which the various industries will exactly clear the

market, without shortage or surplus, of that part of money income that is on offer for net investment. "With an accounting rate of interest thus arranged the planning authority can place itself, for this species of allocation, in as good a position as capitalism." There is no reason to suppose that "the free play of self-interest under capitalism tends to bring about every year the optimum amount of capital maintenance and net investment," and "certainly no ground for asserting *a priori* that in this field socialism will produce situations less favorable to general well-being than capitalism would do."

In his final "confession of faith" Professor Pigou says that if he had power to direct his country's destiny he would accept for the time being the general structure of capitalism but would modify it gradually. But, "he would add, in large capitals, a final sentence that gradualness implies action, and is not a polite name for standing still."

On the whole we like this book.

A. B. WOLFE

Ohio State University

Danish Agriculture, Its Economic Development, by Einar Jensen, Principal Agricultural Economist, U. S. Department of Agriculture, Washington, D. C. Copenhagen, Denmark: J. H. Schultz Forlag. 1937. xvi, 417 pp \$3.75.

About the first definite conclusion that Einar Jensen formulated about Americans after he came to this country in 1926 was that somebody needed to write them a book about Denmark that would present his native country to them in terms of fundamental economic, geographic, and historical factors, to take the place of the magic tales he heard everywhere of how folk schools and cooperation had salvaged a desolate people living in a barren land. After hearing Denmark discussed in lectures in economic history at Minnesota and Harvard, he concluded that writing such a book was a needed service to humanity and that he alone could adequately render it, and he was able to convince The Rockefeller Foundation that the task was enough worth doing to justify a grant for it.

That Dr. Jensen has not failed to realize his purpose is evidenced by the following comments made by Secretary M. L. Wilson in a letter to the reviewer: "It is just the kind of book I have wanted for some time. Like many another, I have read a number of popular, more or less emotional and enthusiastic treatises on Denmark; but none of them has analyzed its agriculture in terms of economic concepts and given the answers to my kinds of questions."

The book was mostly written around 1931. It intentionally does not include the developments in public agricultural policy that seem to have come since to Denmark pretty much as to other countries. One finds instead occasional footnotes with a definite suggestion of nostalgia for the old times

in them: "This refers to the pre-depression conditions." "These countries have now been forced into numerous uneconomical restrictive measures," etc. The subtitle of the book is: "A description and economic analysis centering on the free-trade epoch 1850-1930." Successful adjustment of agriculture to world conditions upon an export basis under free trade is a central theme of the study. But this does not mean that Denmark has remained a wholly agricultural country. Manufacturing provides jobs for 28 per cent of the gainfully employed persons as against 33 per cent in agriculture. The parallel figures for the United States are 29 and 21 per cent (1930).¹ Contrary to Friederich List's doctrine, Denmark has made the transition from an "Agrar-Staat" to an "Industrie-Staat" without protection. Dr. Jensen is careful to state, however, that the developments in Denmark can be taken only as "an example of what is possible under certain conditions." He apparently considers these conditions, however, to have been usual in the world in the period 1870-1930.

Another essential theme of the book is that the transition from grain farming to livestock production in Denmark and elsewhere in Europe was not forced by American competition but was well under way before the era of low grain prices. It represented instead a fundamental adjustment of food production and population to each other, which had the effect of replacing food grains by feed grain used as a supplement to forage.

The early chapters present the important background information concerning the natural bases of Danish agriculture, the Danish social background, industrial and commercial policy, and the effects of the inventions and technological developments constituting the "agricultural revolution." One long chapter is devoted to the influence of monetary factors, tariffs, and international trade. Two chapters trace the changes in the agriculture of Denmark decade by decade from 1875 to 1930, first, for the country as a whole in terms of acreage, yield, production of different crops, livestock numbers and production, and imports and exports; and second, in terms of the organization, receipts, expenditures, and net income of a representative farm that made the typical changes through which Danish agriculture passed. Here we see the subsidence of cereal production reflected in a decline of receipts from this source from 1693 kroner in 1871 to 645 in 1901, accompanied by a rise in butter receipts from 299 to 2101 kroner, and hog receipts from 378 to 1199 kroner. Another interesting table compares the probable incomes by decades from 1881 on one of these farms if following the old and the new systems of farm organization. By 1912 the livestock type of organization was yielding a net spendable income of 3548 kroner as compared with 1494 if the farm had adhered to cereal production.

Such an analysis provides an explanation of developments in Danish agriculture that necessarily calls upon cooperative marketing and related

¹ Probably not strictly comparable. See Galbraith, J. K., and Black, J. D., "The Quantitative Position of Marketing in the United States," *Quarterly Journal of Economics*, May, 1935.

formulae for relatively little directly. Dr. Jensen concludes his analysis, however, with a long chapter reviewing carefully both the direct and indirect contributions of cooperative organization and methods, and assigning to these an important role in facilitating the needed changes and augmenting the income from the new agriculture, particularly because of the part they played in improving quality. Danish cooperation is described as "a non-political movement concerned with practical problems," but the cooperatives have contributed in no small way to making "the Danes a more democratic people than any other." An interesting correlative pointed out is that they have shunned government in their cooperative affairs, and they have also shunned the help of the technically trained, especially of business experts, sometimes to their downfall. They have believed that hard common sense would solve almost any problem.

The principal shortcoming of the book is its inadequate treatment of differences in types of farming by regions and in the same region. The reviewer is aware that limitations of space and time are mainly responsible for this; nevertheless the budget analysis of Chapter IX much needs to have been extended to a score or so of other sizes and types of farms found in important numbers in various parts of Denmark. No doubt also a more detailed study of the developments which Dr. Jensen has traced would reveal that he has at times oversimplified—for example, in his treatment of monetary factors and of competition from the New World—and that he has not analyzed as closely as one could desire. But these too may be due entirely to lack of time and space and a desire to write a book that would reach a wider public than professional social scientists.

JOHN D. BLACK

Harvard University

The Federal Reserve Bank of San Francisco, A Study in American Central Banking, by Parker B. Willis. New York: Columbia University Press. 1937. xiii, 277 pp. \$3.00.

In spite of the relatively high degree of central control and uniformity of procedure which exists in the Federal Reserve System of today, there is a sufficient number of differences in problems and policies to be found in individual Reserve banks to warrant such special studies as Willis, Clark, and Griswold have recently made of the San Francisco, New York, and Chicago Reserve Banks, respectively.

The Twelfth Federal Reserve District in particular has not only experienced a distinctive economic development, but within its borders branch banking has been developed upon a far more extensive scale than has been the case in any of the other districts. Such familiar problems of central banking, therefore, as member and nonmember relations, credit control, and interdistrict relationships, acquire an added interest when they are presented in connection with the San Francisco Federal Reserve Bank.

The first 79 of the 277 pages which the Willis study contains are devoted to a survey of such background material as the regional type of central banking and its suitability to the relatively remote and financially independent Pacific Coast area, the economic geography of the Twelfth District, and the history of banking in California with some rather sketchy paragraphs covering banking in the other states which form the district.

The author then launches into his subject proper, with discussions covering successively: the establishment of the Bank, its operations, the rôle played by bankers' acceptances and bankers' balances in the district, and the interdistrict and international banking relations of the area. A final chapter of but slightly over four pages in length is devoted to a summary and conclusions.

In this concluding survey, the author expresses his agreement with Lawrence E. Clark in his study of the New York Reserve Bank, that the System's original ideal of a number of practically independent Reserve banks of substantially equal importance and autonomy has not been fulfilled. Instead, there have developed three agencies, viz., the Reserve Board, the New York Reserve Bank, and the group of 11 smaller Reserve banks, with credit policy largely in the hands of the first two agencies. Dr. Willis adds, however, that the other Reserve banks have made important contributions to the growth and improvement of banking in their respective districts. The contents of portfolios have been improved in quality, the use of acceptances has been fostered, and Government examination and supervision placed upon a much higher plane, and the several districts provided with an ample supply of currency.

During the 1920's the San Francisco Reserve Bank was drawn into the controversy over branch banking through the necessity of its approving each application for a branch. The author feels that the Bank should have taken "more positive and prudent action" in the matter.

Although the former hostility to the Bank has given way to a feeling of friendliness on the part of the banks of the district, there is still relatively little use made of its rediscount facilities, especially by the urban banks of the area.

The wholesale absorption of banks in the Twelfth District into branch and chain organizations has lessened the need for the services of the Reserve bank with respect to clearings and collections, as well as credit accommodation, but it still has an important rôle to play in furthering the development of a strong discount and money market on the Pacific Coast and in facilitating the financing of the area's foreign commerce.

Although the regional plan of central banking, in Willis' judgment, has been vindicated, he concludes that "a branch of a large central bank could have performed almost as effectively as the present bank has done."

In the first of the three appendices, the figures from the United States Census of Manufactures are reproduced for the states of the Twelfth Reserve

District covering the decades from 1860–1910. A second appendix is given over to a list of the more important securities on the board of the San Francisco Stock Exchange at the time of the panic of 1907. In the third are reproduced the by-laws of the San Francisco Reserve Bank. No date accompanies them, but a glance at their content soon reveals that they are not up to date. A complete bibliography and carefully prepared index follow.

Dr. Willis has done a careful and painstaking piece of work. He has supplemented all the available published material on this subject with extensive personal interviews with Reserve bank and other banking officials of the district. The real intimate story of the frantic efforts made in the crisis of 1920 and again in 1930–1933 to keep a badly disordered banking system in order would make far more interesting and exciting reading than the present dissertation, but it will not be expedient to produce such a work until the present generation of bankers has gone. Unfortunately, by that time, most of those who know the real story will have gone with them, but if the credit and correspondence files are preserved, they should contain some valuable lessons on banking as it should not be done.

GEORGE W. DOWRIE

Stanford University

The Dollar, A Study of the "New" National and International Monetary System, by John Donaldson. New York: Oxford University Press. 1937. xix, 271 pp. \$3.75.

In every respect but name, this is an elementary textbook on money—and a poor one. It begins by discussing "monetary terms," then devotes Part One to the internal and Part Two to the international aspects of recent dollar policies. Historical introductions to individual chapters (on a bare undergraduate level) maintain the textbook character, as does the insertion of "theoretical" chapters. The division of the subject into external and internal policies is a clumsy approach which compels repetition and breaks up the logical course of analysis.

Some sixty pages are devoted to monetary theory; the author's presentation is even less sophisticated than one would expect from an elementary textbook. The reviewer is somewhat embarrassed to find the proper words with which to describe an "economist" who writes as follows:

Thought about money might be classified into: (1) Pure theories undertaking to *explain the value of money*. (2) Pure theories undertaking to explain its *purchasing power*. (3) Ideas about different *monetary standards*. . . . (4) Ideas, or rules evolved, concerning the *operation* of a monetary system. . . . (5) Ideas as to what are the proper or desirable ends of monetary policy. . . (p. 59, author's italics).

This is typical of the embryonic state of theoretical thought in which Professor Donaldson finds himself. As another example, he distinguishes (pp. 56-57) between "quantity theories" and "marginalist theories and the various forms of 'income theories' " without realizing their fundamentally common ground. The theoretical discussions which the volume offers do not amount to more than a superficial enumeration and quasi-classification of a few undigested books, nor have they anything to do with the analysis of dollar policies which fills the major part of the book. This appraisal of American monetary policies between 1933 and 1936 is announced in the Preface as the essential purpose of the author's endeavors.

As to the way in which this promise is fulfilled, *difficile est satiram non scribere*. In the first place, no analysis of the American banking structure is offered; the reader would be scarcely aware, for example, of the fact that the ratio between loans and investments in bank portfolios has been almost reversed, and nothing is said about the monetary implications of such a development. Secondly, the whole set of new policies, such as the regulation of security issues, margin requirements, eligibility of bonds for bank portfolios, etc., of which the old-time monetary textbook did not even dream, are also conspicuous through their virtual absence in this book. Thirdly, the author practically ignores the existence of a problem involved in the huge gold reserve of this country, or at any rate fails to attack it, as he also fails to visualize the artificial character of the prevailing interest rate structure and the problems which are thereby created. In short, none of the essential issues of monetary policy are discussed. What is offered is a lengthy reproduction of monetary laws, supplemented by a substantial quantity of statistics dealing with prices, production, foreign trade, national income, gold and capital movements, and what not. The net result of lengthy discussion, much of which has little relevance to monetary problems, is such a quotation from a League of Nations' report as "new credit creation by Government policy has in many cases failed to restore the velocity of circulation" (p. 114). Very true, indeed, but one would like to ask what happened in the other than "many cases," and why and how did this or that happen. These are futile questions, so far as the present book is concerned.

Limitation of space forbids the enumeration of factual errors or the lack of conclusions—a curious distinction of the book under review. What, for instance, is its position with regard to the gold standard and managed currency? It *seems* to be for some form of paper money, because (p. 139) neoclassical theories "must discard" the theory of automatic gold flow, and because "paper currency . . . can scarcely be conceived of without some type of control." But, "on the other hand," he hastens to add (pp. 139-40) with a disarming naïvete, the dollar "still has a nominal gold content and the Treasury has a gold-price policy." Theoretical analysis and factual description are rarely to be found in such hopeless mix-up. "The final problem," so it continues on page 143, "for the currency management lies in its lack of a rigidly fixed criterion. . . ." Do we turn against monetary management?

"But the great merit is in the flexibility of adjustment." Are we for it? "On the other hand, once a reasonable adjustment is obtained, there is no reason why very great further changes need be made in the exchange rate for a considerable period . . . , " which means, if it means anything, that the professor is against the gold standard, but for rather stable exchanges "for a considerable period" which is approximately the gold standard. But, "on the other hand," I would not dare to be sure of the implications of such diplomatic language suitable (perhaps) for international conferences of an official type, where nobody is supposed to offend anybody else's feelings and everybody is permitted to indulge in inconclusive reasonings which one cannot read without impatiently waiting for someone to bring some order into an intellectual chaos.

MELCHIOR PALYI

University of Chicago

The Reorganization of the American Railroad System, 1893-1900, by E. G. Campbell. New York: Columbia University Press. 1938. Studies in History, Economics and Public Law, Edited by the Faculty of Political Science of Columbia University, Number 434. 366 pp. \$4.50.

In view of the widespread distress among the railroads, one tends to search the story of past railroad reorganizations for light on the present problem. Dr. Campbell's instructive account of railroad reorganizations in the 1890's is not directly pointed for the current plight, but his emphasis on the growth of distress, the development of systems, and the focalization of financial control seems nevertheless to make the study timely.

A number of great railroad collapses are associated with the panic of 1893, but the clues to those disasters are shown by Dr. Campbell to lie, not so much in the immediate impact of that panic, but in the earlier superb build-up for trouble. Both straightforward heroic pioneering and the normal modicum of shadowy maneuvering were there in abundance. Construction that ran far ahead of population would have brought enough financial grief, even if promoters had been altogether honest, merely deluded by overconfidence, merely now and then mistaken. The strains developed by overexpansion could hardly have been wholly relaxed, even if considerations of traffic economy alone had dictated the form and the extent of integration into systems. All the more certain was a day of reckoning in view of the great extent to which the essential job of transportation was overshadowed by the exhilarating pursuit of gullible domestic and foreign investors. And, in view of the great extent to which the leaders of transportation had used their main job as window dressing for financial play, one can hardly visualize the parade of failures marching elsewhere than to the halls of big finance.

Much of the system building preceding the crashes of 1893 reflected far-

seeing attempts to gain diversification and resultant stability through territorial spread. All such spread, however, was subject to the inclusion of moves aimed at limitation of competition, if not at development of regional monopoly.

In the process of reorganization, the prunings, annexations, and consolidations seem generally to have been shaped toward attaining a measure of monopoly sufficient to support rates adequate for designed financial structures. And, with so great a part of the reorganization problem falling to Morgan and his allies, it is not surprising that systems often were worked out to attain harmonious exclusiveness of territorial rights.

It must be observed, however, that, although the stronger among the financially minded did what they could to preserve rate structures against too much competition, they also cut fixed charges wherever it seemed necessary. It may be noted also that, since regulatory agencies were too weak to share the control and competing forms of transportation were fringe phenomena, the solutions in that period of reorganization must be accredited to fairly free giants of railroad finance. Co-ordination, consolidation, and reduction of fixed charges were in the formulae of practical men.

Scenes change. In view of the motor vehicle, a resurgent maritime policy, changed labor conditions, rather stringent financial regulations, and the insistent coloring of the rail regulation with the concept of co-ordinated transportation, the devices of the 1890's may not be the devices for today. On the other hand, the idea of the changing scene may have been over-worked. At any rate, this reviewer is grateful to Dr. Campbell for his instructive record of those reorganizations and their background.

J. P. WATSON

University of Pittsburgh

International Trade, by Hugh B. Killough. New York and London: McGraw-Hill Book Company, Inc. 1938. xiv, 622 pp. \$4.00.

In this well-organized and carefully documented work on international trade there is a wealth of information. The descriptive side of many problems is carefully examined. As a textbook it should be useful especially in courses in foreign trade.

For review purposes the book may be divided into four general sections. After a brief introductory treatment of the conditions and characteristics of trade across national boundaries, there are almost a hundred pages of historical background material. In this historical section both the theory and the practice of international trade are traced from ancient civilizations through medieval localism and English mercantilism up to the specialization and world-wide trade of the twentieth century. Special attention is given here to the writings of Smith, Say, Ricardo, Mill, Hamilton, and List.

The second section is devoted to the industrial foundations of twentieth century commerce. From the point of view of those interested in obtaining

factual information concerning the distribution throughout the world of population, food resources, power resources, foreign investments, and basic raw materials this is undoubtedly the most valuable portion of the book. The statistics cover not only quantity and value of goods entering international trade but also present tabular and charted information regarding total production and prices.

The third section contains some modern theoretical analysis under the heading of "Twentieth Century Practices and Principles." Even here there is considerable stress on the factual side of the problems, especially in the examination of the international balances of payments and the interaction of foreign exchange rates. In the treatment of comparative advantage and the gains from trade the analysis is quite similar to the marginal cost technique used by Haberler. There is almost no attention given to the theoretical problems arising from cyclical changes, credit shifts, or shifts and changes in supply and demand curves for particular commodities. For the author to expand on these features of international finance and trade theory, however, would necessitate restriction of statistical analysis or would result in an unwieldy text.

In the final section of the book, which describes recent commercial policies and tendencies, the author maintains his world-wide outlook and examines the pertinent policy features of Great Britain, France, Germany, Italy, Japan, Russia, as well as the United States. Particular attention is given to the advantages and disadvantages of tariffs in relation to the United States. It is rather unusual in these times of intense international rivalries and growth of economic programs of self-sufficiency that the author concludes with the following optimistic note, "The United States is moving in the direction of more participation in world economy, not less." Although this observation may be based on wishful thinking, rather than clear-cut economic trends, it gives evidence of the significance which the author attaches to international trade relations.

Even though the book is intended and best suited for the use of undergraduate students in foreign trade courses which are designed to give carefully integrated information concerning international trade and trade policies throughout the industrialized part of the world, it may have some considerable value to the more advanced student because of its exhaustive bibliography. This latter feature is classified in regard to both subject matter and form.

Since most of the book is institutional and descriptive, one might reasonably expect more attention to be given to the reciprocal trade agreements program of the United States and also to the character and effects of so-called administrative protective measures, i.e., customs formalities, veterinary and sanitary regulations, etc. Yet, one risks understatement when he concludes that Mr. Killough has here produced a useful textbook characterized both by a fine sense of perspective and considerable evidence of careful research.

EDWARD C. WELSH

Ohio State University

Population Pressure and Economic Life in Japan, by Ryoichi Ishii. Chicago: University of Chicago Press. 1937. xix, pp. 259. \$3.00.

Dr. Ishii has provided for all students of population trends and of Japan's social and economic conflicts an indispensable study. Beginning with a resume of population trends before the Restoration of 1868 the author traces the population growth since that time, analyzing it from a regional and occupational point of view, followed by a demographic analysis. Succeeding chapters discuss the rural economic situation as affecting population trends, the problems of food supply and colonization and immigration and industrialization as remedies for overpopulation. The last chapter discusses birth control and the distributive system. The peculiar value of the work to Westerners without a reading knowledge of Japanese is its primary dependence upon Japanese source materials. Some 115 statistical tables are provided, which are sufficient to enable the critical reader to follow and appraise the value of his interpretations and conclusions.

Two important lacunae among the few sources in Western languages cited by the author have already been noted by Professor Corrado Gini of the University of Rome in his review of the book in *Pacific Affairs* (December, 1937, pp. 480-83). These are the set of demographic, economic, and social studies presented by Japanese statisticians to the 19th Session of the International Institute of Statistics at Tokyo in 1930 and the lectures of S. Nasu and some Western scholars published under the title *Population*. Use of these materials would have strengthened his work at several points. Likewise his treatment fails to make use of Yanagisawa's "Histoire critique des travaux statistique au Japon depuis l'antiquité jusqu'à la restauration imperiale," *Bulletin de L'Institut Internationale de Statistique*, 1911. His material on pre-Restoration population trends fails to contribute anything new. His assertion that the stationary population of the Tokugawa Era is primarily due to the practices of abortion and infanticide is an oversimplification, as Professor Gini had previously disclosed in a review of the Tokyo session of the International Institute of Statistics above mentioned (see *Metron*, Vol. IX, No. 1, Feb. 1, 1931).

Throughout his study the author has made an effort to bring out the close relationship between the population trend and the economic situation. In so doing he minimizes the role which human agencies operating particularly through the state do or might play in determining that situation. Thus in the interests of national defense the state would not consider that overpopulation exists in rural Japan—the reservoir of their military strength. Measures designed to improve rural conditions through an increase of production which would lead to a reduction of the rural population by half would meet with the strenuous opposition of the militarists. They prefer as at present to subsidize the surplus population on the land through relief measures and rice control laws. Likewise measures such as birth control and even efforts at more equitable distribution of income which would result in increased standards of living and lowered birth rate meet with the opposition of vested governmental and economic interests. Although it is true in large degree

in an immediate sense that "population trend is influenced chiefly by conditions and desires of individual families and only very slightly by public dictation" (p. 254), the policies of increasingly more powerful states do create and determine those economic and social conditions which markedly and indirectly over a period of time restrict the range of individual action and choice even in this most intimate field of human relations. Growing awareness of this fact should lead to an accompanying sense of responsibility for social and individual welfare on the part of the still largely irresponsible state. Japan stands in the front rank of those nations that fail most glaringly in this respect and consequently has an acute population problem on its hands.

Japan's problem takes the more concrete form of providing work for some 400,000 more workers each year (E. F. Penrose estimates 200,000) for some years to come, while an eventual solution awaits the year 1960 when Dr. Ishii estimates a maximum population of between 80 and 90 million for Japan Proper will be reached. Dr. Ishii believes, as do most observers, that in further industrialization lies the hope of finding work and means of subsistence for the millions yet to come. Other observations and conclusions reached by Dr. Ishii all merit comment if space permitted. He has written a highly meritorious work which goes far to explain contemporary Japan—its problems and its policies.

CYRUS H. PEAKE

Columbia University

International Raw Commodity Price Control, by Robert F. Martin. New York: National Industrial Conference Board, Inc. N.I.C.B. Studies Number 238 October, 1937. xvi, 166 pp. \$3.50.

The bitter conflict between man and his environment has been shifting its emphasis in recent decades from the struggle to produce to efforts toward control of what is produced. No better evidence of this struggle is needed than that contained in Dr. Martin's contribution to the literature of price controls. Competitive markets for such foodstuffs as coffee, tea, sugar, and wheat, and for the essential raw materials, cotton, silk, rubber, copper, and tin have been too competitive to satisfy producers. Failing to control either prices or production, they have watched prices drop to levels which were unprofitable to many of them or at least not profitable enough to satisfy them. The consequence has been a turning to government or the exercise of various monopolistic types of control, first of prices and later of supplies and production. The history of these various price controls as revealed by statistics of prices and stocks, between the years 1920 and 1936 for the most part, of the nine commodities mentioned is told by Dr. Martin in this compact volume, which he prepared originally as his doctoral thesis.

Dr. Martin is well qualified by long experience in the Department of Commerce and in the National Industrial Conference Board to handle a statistical study of this sort. He has confined himself quite rigidly, too much so in

the opinion of this reviewer, to a purely descriptive and statistical approach. A general chapter on price controls is followed by nine chapters, each of which describes a particular commodity. The book lacks both index and bibliography but contains a useful statistical appendix which includes monthly price quotations and indexes of each of the nine commodities from January, 1920, through December, 1936, as well as similar data on visible world supply for coffee, cotton, tea, tin, and wheat for the same years. Copper, rubber, silk, and sugar supply figures are not available for all of the earlier years. Sources of these data and methods of compiling indexes are also explained in the appendix.

Apart from the tabulations in the appendix only one statistical table is used in the text, and this unfortunately omits references to the source of the data. Charts and graphs are used liberally and effectively throughout the study in presenting the statistical material

Paralleling the neglect to include a bibliography is the general paucity of references throughout the text to source material and to earlier studies. To illustrate, this reviewer could find no reference in the chapters on coffee and rubber to other contributions on this subject. Such a book as the Brookings' study, *International Control of Raw Materials*, by Wallace and Edminster, for example, is not cited.

Dr. Martin's study is a concise statistical handbook which should provide a useful reference work to students of price control as well as to business men and students interested in foreign commerce.

N. H. ENGLE

Washington, D. C.

April 6, 1938

World Prices and the Building Industry, Index Numbers of Prices of 40 Basic Commodities for 14 Countries in Currency and in Gold and Material on the Building Industry, by George F. Warren and Frank A. Pearson. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1937. v, 240 pp. \$3.50.

The general monetary thesis of this book, which is the fourth in "The Price Series"¹ written by Professors Warren and Pearson of Cornell University, differs little if any from those of its predecessors. Because, in the words of the authors, "the most significant business factor to consider since 1914 has been the changing price level, that is, changes in the value of money" and "the next most important business factor is the building cycle" (p. iii), the first part of the book attempts a comparison of the prices (in both gold and currency) of basic commodities in various countries, and the second part is devoted to the building industry. A total of 190 graphs is offered in substantiation of the validity of the general argument and of the belief that "changes in the value of money" merely mean changes in the quantity of gold and/or variations in the demand for this metal.

¹ *The Agricultural Situation* (1924), *Prices* (1932), and *Gold and Prices* (1935).

Although the monetary theories of Professors Warren and Pearson have already evoked considerable comment from capable scholars of monetary matters, it might be apropos to suggest anew a few relevant points in criticism of their theories. The quantity theory of money (which, at best, should be considered applicable only in the long run) is modified by the authors as being $G = PT$, where G is the quantity of gold; P , the price level of basic commodities; and T , the volume of trade. The authors are really commodity theorists. Bank and private credit, its velocity of circulation, and even the velocity of circulation of gold are considered of such minor importance in determining the price level that they are virtually ignored (see, especially, p. 76). It is stated (p. 64) that "if a country raises the price of gold at a time when the world value of commodities is stable, internal prices will rise *in proportion to the advance in the price of gold*" (italics of the reviewer). That a country may "sterilize" a part of its gold stock for either a long or a short period of time is not recognized as even a theoretical possibility. Changes in the world's "economy" of gold such as the increasing use of deposit banking with lowered fractional reserves and the adoption of the gold exchange standard, it would seem, are thought to have had no substantial effect on world prices.

Professors Warren and Pearson fail to appreciate adequately the fact that the present-day monetary system gives rise to problems different from those facing countries in which gold coins or certificates constitute the only circulating medium. They admit, however, that the policies of central banks may affect the world value of gold but only in the short run (p. 94). Although one may claim, of course, that over several centuries these short-run changes in banking policy may cancel and leave the trend of prices in harmony with the trend of gold production, there is no historical justification for assuming that such will be the case. Is it reasonable to assume that the world will readopt its 17th- or 19th-century monetary and banking policies in the next hundred years? The authors fail to recognize that, if all central banks and banking systems in the leading countries of the world pursue the same monetary policies, the value of gold may be permanently changed. For any realistic study of business activity, furthermore, it is the short-run changes in monetary policy which are important.

This narrow interpretation of the quantity theory naturally leads to the view that the only way to raise the price level, if the gold standard is to be maintained, is to increase the currency price of gold via revaluation. In support of this thesis Professors Warren and Pearson show that the price level of 40 basic commodities rises as the gold value of a nation's currency is decreased through devaluation. It is important to note that the majority of these basic commodities have international markets and prices. Few 19th- and 20th-century economists have denied that devaluation results immediately in increased prices of imported commodities and somewhat later in rising prices of exported commodities. One is puzzled, therefore, at the authors' surprise over their "discovery" that the price indices of their 40 basic commodities vary inversely with revaluation.

When the reviewer first received his copy of *World Prices and the Building Industry*, he expected to find an analysis of the building cycle in terms of Mr. Keynes' profit inflation and deflation. Many theorists and economic historians agree that selling prices in general rise much faster than cost of production (and other "sticky" prices) when the quantity of circulating medium is rather suddenly increased, thereby causing business booms. The 16th- and early 17th-century "price revolution" occasioned by the discovery of America and the theft of its vast treasure hoards is thought by Mr. Keynes¹ and Professor Earl J. Hamilton² to have played a considerable rôle in the rise of capitalism in Western European countries, but adequate price data which would permit a careful analysis of the cost-price situation for these earlier centuries are still wanting. Professors Warren and Pearson, on the other hand, are embarrassed by the abundance of statistics for the 19th and 20th centuries. It was thought, therefore, that their two problems—the changing price level and the building cycle—would be dovetailed and the profit-inflation theory of business prosperity either substantiated or qualified. Such is not the case. The first chapter of their book, however, treats the relationship of prices of basic commodities to other prices, namely, agricultural and industrial wages, the cost of living, prices of manufactured and processed goods, administratively set prices, interest rates, and taxes; but the full significance to business cycles of the relative "stickiness" of some prices which is revealed is completely ignored. The changing disparities between building costs and rental or sales values are assigned no rôle in their analysis of the building cycles, which are said to have averaged 18 years in length in this country from 1830 to 1936 and slightly longer in Europe.

The authors believe that "there is no such thing as a definite business cycle . . ." (p. 154) but that what is generally meant by the term is merely a composite of the production cycles of all goods. "Business," it is stated, "is the algebraic sum of many forces" (*loc. cit.*). The significance of such a statement escapes the reviewer. "Much greater progress in studying business cycles will be attained when, in addition to changes in prices, studies are made of each individual industry, and these forecasts combined rather than attempts made to learn from the scrambled effects" (p. 157). In Chapters VIII and IX the production cycles of food, textiles, automobiles, buildings, horses, cattle, sheep, hogs, and eggs are compared with general production cycles, and the trends are found to be *only broadly* similar. Few economists would question the relevancy of production cycles in the steel industry, for example, to swings in general business activity; however, the analysis of business cycles suggested by Professors Warren and Pearson would require a careful study of the swings in the production of all commodities—or, at least, of all basic commodities. The great danger, of course, from such analysis is that one would most likely be unable to see the forest (i.e., to understand general cyclical movements of the past and to forecast business changes) because of the large number of individual trees.

¹ *A Treatise on Money* (New York, 1930), II, 152 ff.

² "American Treasure and the Rise of Capitalism," *Economica*, November, 1929.

Who has denied that the building industry *affects* other phases of our economy? The authors' attempt to demonstrate that the state of this industry *causes* prosperity in transportation, banking, and manufacture generally (Chapter VII) is, however, unconvincing. Were one to compare the automobile production cycles with those of other industries, one would certainly see similarities in their trends, perhaps much greater than those indicated in Figures 1, 8, 9, and 14 of the same chapter.

Those students who have desired at one time or another price data compiled on a comparable basis for the United States, Canada, England, the Netherlands, France, Belgium, Italy, Spain, Bulgaria, Australia, Germany, New Zealand, Sweden, and Finland since 1910-13 will appreciate Professors Warren and Pearson's contribution in this regard. It is regrettable that the composite index of the world price level is composed only of those indices for the United States, England, France, Spain, Canada, the Netherlands, and Belgium (p. 18, n. 1)—all of which countries are either North American or Western European; China, India, Japan, Russia, and South America certainly play more important rôles in international economics than Spain, Belgium, and the Netherlands. The authors apologize for not having included in the world composite index their price indices for Australia, New Zealand, Finland, Sweden, and Germany (*loc. cit.*); but the fact that the charts were already drawn before these data were available is not, in the opinion of the reviewer, sufficient justification.

WARREN C. SCOVILLE

The University of Texas

Analyses of Business Cycles, by Arthur B. Adams. New York: McGraw-Hill Book Company, Inc. 1936. xi, 292 pp. \$3.00.

Events of far-reaching importance to business cycle analysis have occurred since *Economics of Business Cycles* was published by Dean Adams 13 years ago. The new book, partially a revision of the older one, indicates an attempt on the part of the author to take into consideration in his theoretical analysis new conditions affecting business cycles.

The principal distinguishing feature of Adams' earlier business-cycle theory was the contention that each business cycle has a definite end which comes when there has occurred a moderate recovery from depression. The cumulative expansion of business during a period of prosperity does not grow out of conditions previously existing. On the contrary, it is brought about principally by an increase in the production of gold, a favorable balance of trade, wars, or a rapid expansion of capital equipment.

In *Analyses of Business Cycles* much less stress is placed on this part of the theory, although the idea of a definite ending is retained. Emphasis is shifted to a large extent to an analysis that hinges on a distinction between two types of cycles: the inflation-deflation cycle and the overinvestment-underconsumption cycle. The chief feature of the inflation-deflation cycle is an inflational rise of the price level on the upswing of business and of a defla-

tional fall on the downswing. The expansion phase of the overinvestment-underconsumption cycle is typified by an increase of the capacity of production greatly in excess of the ability of consumers to purchase the goods produced. Whereas Dean Adams formerly treated price rises and business expansion as twin processes, in his revised theory he dissociates the two when he discusses the overinvestment-underconsumption cycle. He even asserts (p. 200) that the price level has little or nothing to do with such cycles. Moreover, the requirements of stability as set forth assign secondary significance to the price level. For stability "it is necessary to maintain a proper balance between net production, national money income, the flow of finished goods, and the expenditure and investment of the income" (p. 25). A balance would tend to be maintained were it not for booms initiated by the "creation and use of a great deal of new purchasing power through the expansion either of bank credit or of government credit" (p. 101).

Although the earlier book, *Economics of Business Cycles*, constituted an important advance toward a general economic treatment of business cycles, and although the present book is an improvement, one has a feeling that there remain some conspicuous deficiencies. *Analyses of Business Cycles* is more largely an analysis of Dean Adams' concept of the problem of business cycles than of quantitative information concerning such cycles. In fact statistical analysis has not been used effectively as an aid in the solution of the problem. A "composite index of business activity" is presented, but it lacks precision because of the inclusion of unrelated series such as those for industrial production, bank loans, and commodity prices without reckoning of the specific service that those series perform in the index.

There are numerous points on which one may disagree with Dean Adams. The chief weakness of the book is that controversial points are usually unsupported with tangible evidence. To choose one illustration: business cycles are assumed in the book to arise largely from growing maldistribution of wealth. On the other hand, some business analysts believe to have satisfactorily shown that there is no more maldistribution now than there was some decades ago. To these analysts Dean Adams offers no reply, nor does he point out the extent to which business cycles and maldistribution may have had a parallel development.

Owing to unanswered questions of this nature and in general to the subjective character of the argument, a wide difference in reaction toward the book is to be expected. Nevertheless, Dean Adams has ably presented his point of view on the theoretical aspects of business cycles.

WILBERT G. FRITZ

University of Pittsburgh

Sales Analysis from the Management Standpoint, by Donald R. G. Cowan.
Chicago: University of Chicago Press. January, 1938. xi, 210 pp. \$2.50.

In this book, which is a revision and expansion of a series of articles previously published in the *Journal of Business* of the University of Chicago,

Mr. Cowan has turned in the sort of intelligently planned, conscientiously executed, and carefully checked piece of work which those interested in marketing research have learned to expect from him.

The volume is just what the title says it is. First, it is an analysis, mainly statistical, accomplished chiefly by the use of correlation, of the sales records of various firms and of market information which is available from various public sources. Second, it is a discussion of the uses which the marketing manager may make of such analyses and their results in enhancing the profitability of the sales operations of his firm.

Mr. Cowan first considers the setting of quotas. He discusses the various methods and devices which have been employed in the work of analyzing the sales potentialities of various geographical areas for specific products. In so doing, he rather completely demolishes the theory that the general index of purchasing power is useful for this purpose. He makes out a very good case for the proposition that the factors indicative of sales possibilities are usually specific for each product or related group of products—sometimes even for each geographical area in which a product is sold.

The author next discusses the various means of measuring the fruitfulness of the several types of sales effort. This involves a description of the statistical devices by the use of which it is possible to discover the influence of the different types of salesmanship, advertising media and appeals, and sales promotional efforts upon the volume disposed of. This discussion leads logically into a consideration of the methods of allocating various types and differing quantities of sales effort to geographical areas, types of customers and products. The means of analyzing the costs of selling and distribution and allocating them to the various elements of the marketing process are described. Mr. Cowan does not go extensively into the accounting technique involved in this work but contents himself with presenting the uses which may be made of such cost data after they are derived.

A final section of the book is devoted to a discussion of the application of these methods of analysis and the results of their use to the problems of managing the selling and distributing activities of the business. Of course, this subject is touched upon constantly throughout the volume. In this section, the author emphasizes the manager's task of coordinating the diverse influences which are brought to bear upon each marketing unit and of harnessing the menacing forces of competition and the erratic and unpredictable pressures generated by shifts in consumer demand to the task of producing profits for the firm whose destinies he guides.

The statistical treatment employed by Mr. Cowan follows the conditions established for reliable correlation results. The reduction of sales and other similar series to a per capita basis and the use of logarithms to give a more nearly normal distribution of each variable represent refinements of statistical procedure which might well be emulated. Although most of the methodology has been quite advisedly omitted, sufficient explanation of the statistical steps has been included in the footnotes to indicate that Mr. Cowan has delicately handled his statistical instruments.

To teachers and others who are seeking examples of the application of statistical methods, the book offers most interesting material. If the interpretation placed upon some of the results, as, for example, the designation of the relative influence upon sales of each of the various independent factors, seems to be somewhat dogmatic, the careful reader will observe that Mr. Cowan is quite familiar with the limiting conditions but has deliberately chosen to subordinate them. His has been the difficult task of applying very technical quantitative methods to a problem in the qualitative aspects of which a very considerable audience is interested. By steering a happy middle course, he has succeeded in demonstrating how fruitful the statistical approach to the problem may be without alienating the interest of those who have little heart for some of the more technical and slippery concepts which multiple correlation involves.

Mr. Cowan is the first to admit the obvious weakness of his volume—"its fragmentary nature." It resembles a mosaic, each piece of which is shaped and placed with infinite care and precision but which is marred by numerous vacant spaces in unexpected and illogical spots, so that, although its pattern is clear and unmistakable, it is obviously an incomplete and piecemeal job. This weakness is inevitable, since the volume is based largely upon the experience and observations acquired by a practitioner of sales analysis during the course of his work in a single industry and because of the further fact that the author has been so busy adding new provinces to the realm of marketing research that he has perhaps lacked the time to work out a complete synthesis of all its parts. In spite of this defect the book is an excellent one which both the students and practitioners of marketing research will find it profitable to study with meticulous care and to keep constantly at hand for reference and suggestion in their own work. The material which it presents constitutes a significant addition to the knowledge and technique available for use in the field.

R. S. ALEXANDER

R. PARKER EASTWOOD

Columbia University

Lectures and Conferences on Mathematical Statistics, delivered by J. Neyman at the Graduate School of the United States Department of Agriculture in April, 1937. Revised and supplemented by the author with the editorial assistance of W. Edwards Deming. Washington, D. C.: Graduate School of the U. S. Department of Agriculture. 1938. 160 pp. \$1.25. Great Britain: Department of Statistics, University College, London W.C. 1. (Foreign postage extra.)

The subject matter for the three lectures consists of a discussion of modern concepts in probability theory and their application to the problem of testing statistical hypotheses. The point of view taken is that of Kolmogoroff, Fréchet, and other continental probabilists and is a postulational approach which reduces the problem to a treatment of a class of functions known as

completely additive set functions. In this theory, "events" are idealized as sets which in turn are represented by sets of points in a space of one or more dimensions (depending on the number of variables characterizing the "event"). The idea of frequency of an event is abstracted by associating a non-negative number (called probability) with the set corresponding to the event. Associated with manipulations and calculations about events and relative frequencies of events (such as determining the number of "cases" having either property A or property B, or both properties A and B) are operations on suitably restricted point sets (Borel sets) and their corresponding non-negative numbers. Adjoining the assumption that the non-negative number associated with the sum of an infinite sequence of nonoverlapping sets is equal to the sum of the non-negative numbers associated with the individual sets, the theory is thus reduced to a consideration of completely additive set functions and the theory of measure.

From a mathematical standpoint this is perhaps the most elegant and logically self-consistent theory of probability which has yet been devised, but, in spite of the fact that notions and suggestions are borrowed from the empirical field and are abstracted, the theory is not a frequency theory of probability. The statistician who thinks of his data in terms of frequencies and is interested in using probability theory in the interpretation of his data will find that the gap which must be bridged by intuition, between this theory and its application to actual observations, is no smaller than that between any other theory of probability and its application.

The discussion on probability theory is admirably carried on with a minimum of technical detail and is greatly clarified by an assortment of numerical examples. Throughout the three lectures the author repeatedly calls attention in one way or another to the danger of confusing the mathematical theory with actual empirical occurrences. In fact, the main theme of the lectures seems to be that the mathematical theory of probability should be considered as a model to assist in making successful predictions about phenomena in which there is an element of "randomness" present, and, in order to use it properly in any given situation, the appropriate model and its limitations should be thoroughly understood.

The six conferences are most varied in content. The first one is a discussion of randomized and systematic arrangements (particularly the half drill strip setup) of field experiments which has been a controversial matter between R. A. Fisher and "Student." The critical point is whether or not significance tests can be devised which will be applicable to systematic arrangements. Dr. Neyman discusses "Student's" method and also his own method of "parabolic curves" for handling the case of systematic arrangements. It will perhaps be of interest to some readers to know that this subject is discussed by "Student" himself in a paper written shortly before his death and which has just appeared in *Biometrika*.

The second conference deals with problems of plant breeding with special reference to the problem of breeding new varieties of sugar beets. The author considers only the case of one new variety, using deviations of sugar

content from a standard, and their sampling theory (assuming the true average deviation is not positive) as criteria for selection.

The third conference is largely concerned with the principles of *stratified* sampling in social statistics. The importance of these principles seems to be realized by successful public-opinion and straw-vote experts. Failure to recognize the essentials of the method of stratified sampling is likely to lead to such disastrous results as those of the *Literary Digest* 1936 presidential poll. The use of *purposive selection* as a device for estimating social and economic characteristics of populations is strongly condemned. As a shining example of the treachery of this method for census purposes, the author cites the futile efforts of Gini and Galvani to preserve the essential characteristics of an entire Italian census by keeping the data of 29 of the 214 *circondari*, the 29 being selected on basis of the means of 12 characters.

The fourth conference is devoted to mildly condemning what is termed "empirical statistical research in economics," although admitting its practical value at present, and praising the "a priori" method. Examples of each type of research are discussed, together with an analogous situation in the history of astronomy in which there was a general shift from an "empirical" to an "a priori" approach at the time of Newton. It is rather evident that the author's primary interest in economic series from a statistical point of view is in the possibility of developing mathematical models from a few "reasonable" hypotheses, which will correspond to economic processes.

In the last two conferences the author discusses on a fairly elementary level some of the fundamental notions of statistical estimation and confidence intervals.

The stress throughout the lectures and conferences has been placed on certain basic concepts in statistical inference. A noteworthy feature of the book is a record of questions from the audience and Dr. Neyman's replies. Theoretical and practical statisticians alike will find the book well worth reading.

S. S. WILKS

Princeton University

An Introduction to the Theory of Statistics, by G. Udny Yule and M. G. Kendall. Philadelphia: J. B. Lippincott Company. London: Charles Griffin & Company, Ltd. 1937. Eleventh Edition, revised and reset. xiii, 570 pp. 55 diagrams and 4 folding plates.

"The *Introduction to the Theory of Statistics* having completed five-and-twenty years of life, it was decided that the time had come when a complete review should be made. . . . In this revision . . . very little of the material appearing in earlier editions has been deleted. . . . The larger changes are almost entirely in the form of additions . . . several new chapters on *Sampling* . . . on the *Moments and Measures of Skewness and Kurtosis*, and on *Simple Curve Fitting by the Method of Least Squares* . . . a new chapter on *Interpolation and Graduation*" (by finite differences). Thus the preface,

without a word about one of the best features of the book, namely, 34 pages of references which are well classified and also *indexed* by author and title and made a part of the general index at the end of the volume. Since the older book is well known, the reviewer will confine himself almost wholly to the parts in this edition which are new. They comprise a very considerable portion of the whole, and so it is rather a pity that it was necessary to leave the remainder of the old book unchanged. The arrangement could have been improved and the general argument simplified had it not been necessary to deal with large chunks of the older work en bloc. Another difficulty hanging over from the tradition of 25 years ago was that it was felt necessary to write the book without using the calculus, except in rare instances. That, in view of the very modern methods which were to be explained, was too much of an order. In general character, the book is not easier reading than the earlier one, and it is safe to say that almost no one is going to study it who has not already attained a fair degree of mathematical maturity, much greater than is involved in the study of a little calculus. Thus, to American students who are accustomed to six weeks or more of baby calculus in their freshman years, this non-calculus requirement is to lay aside an easy and facile tool, and it implies that nothing worse than freshman mathematics is to be encountered, which is not at all the case. Another subject curiously omitted, except for brief references here and there, is the theory of probability. There are touches of it in connection with the theory of the point binomial, but in general even there the emphasis is on the study of the point binomial as a statistical phenomenon rather than on the solution of problems in probability by means of the point binomial. Hence there is only slight reference to the use of the normal curve in finding the sum of a number of consecutive terms of a point binomial, and there is no attempt to secure a better approximation by a skewed curve.

In spite of these omissions, the author has managed to deal with the newer subjects mentioned above with clarity, and in most cases to give enough of the mathematical background to enable the worker to see why various rules are laid down for him. In this respect the book is a distinct improvement over some of the guides for the research worker which give only the rules. Moreover, the authors take pains to discuss rather at length the various limitations and possibilities of their methodology. This is a comfort. One need not read a sentence over six times in order to find out exactly what it does mean and what it does not. There are two or three other sentences that go with it, and they can be read instead. In form and printing the volume is a great improvement over the earlier edition. The binding is poor. There are many good problems with each chapter and a list of answers at the end. There is a sufficiently adequate set of tables. The "summaries" at the end of each chapter are a valuable addition.

Probably most interest in the revision will be in the three new chapters on *Sampling Theory*. In the first of these the authors prove the customary formulas for the standard errors of percentiles, mean, difference of two

means correlated or not, moments, standard deviation (not done rigorously), correlation coefficient, Pearson's β_1 and β_2 correlation ratio, and multiple correlation coefficient. Karl Pearson's development of this theory is followed closely. Some of the demonstrations could have been improved by the use of semi-invariants. In deriving the formula for the correlation between the errors of percentiles (p. 385), use is made of the unproved assumption "that missing observations tend to be spread over the other sections of the curve in proportion to the respective areas and thus tend to produce an error, etc." As has been shown by the reviewer* this assumption can be obviated by a simple use of the multinomial theorem.

The next chapter is devoted entirely to the chi-square distribution, an excellent account in general, so far as was possible with the mathematical limitations imposed at the outset. There is one minor criticism, however. From Weldon's dice data P is found to be about .00072; from the same data the observed mean is found to differ from the theoretical mean by about five times its standard deviation, leading to a probability of about .000003, and so the authors say: "We see that the data are really more divergent from theory than the chi-square test would lead us to suppose." It would seem to be better to say that two different hypotheses are being tested here, and that the first is not so surely to be rejected as is the second.

The third of these chapters deals with Student's distribution, with Fisher's t pertaining to a mean, Fisher's z pertaining to the difference of two means, with the analysis of variance, and some corollaries, and with the distribution of the coefficient of correlation, the parent universe being normal in all cases. Not a very thorough account is attempted for the analysis of variance, "not more than . . . to explain the general principles of the method," and it is not as satisfying as is the discussion of some of the other subjects, but it is readable and helpful.

The final chapter in the book is also new: *On Interpolation and Graduation*, by Mr. Yule. Wisely, we think, considering the limited objective, the author restricts himself to Newton's series and its immediate consequences. His account of inverse interpolation is too short, being limited to finding the inverse solution of the best fitting quadratic parabola. At least he might have stated that, whenever direct interpolation can be done successfully, one can interpolate inversely by first subdividing the intervals by direct interpolation (a process he has explained), and then using linear interpolation to get the inverse solution desired. Indeed, for functions which, in the direct form, are polynomials, this is a surer method than certain of those "more direct methods given in advanced works." There is an illustration given in this chapter which is so striking that it deserves repetition in full.

Thus, in the Census of England and Wales there are conspicuous peaks at the round-numbered ages 30, 40, 50, etc. (last birthday), and hollows or deficiencies at the ages ending with 1 and, less emphatically, at the ages ending with 7. With returns from less educated populations, the phenomenon may become almost ludicrous, e.g. in a certain Indian census sample-count:

* The Multinomial and the Chi Test, *Transactions of the American Mathematical Society*, vol. 81 (1928), p. 135.

Age Last Birthday	Number of Males
29	927
30	12,294
31	652
32	2,058
33	672
34	892
35	7,723
36	1,437
37	870
38	1,362
39	467
40	10,391
41	460

The scope of a book like this may be indicated by listing both the topics it includes and some that it does not include. The following are either omitted or considered only very briefly: likelihood in Fisher's sense, fiducial limits, efficiency of statistical estimates, inverse probability, polynomials of Hermite, Pearson's curves (mentioned very briefly), frequency curve fitting, graduation by means of a normal distribution of a series which is ordered but not measured, correlation in contingency tables between ordered but not measured characters, polychoric r . The last two subjects are covered partly by a remark about tetrachoric r , but this, the authors say, involves some difficult mathematics and "is outside the scope of the book . . . The student should realize that the product-sum correlation and the tetrachoric correlation are . . . two entirely different measures. . . . The one is in no sense an approximation to the other." This statement is very misleading, for if the distribution is exactly normal the two measures are exactly equal and mean the same thing. The mathematics for tetrachoric r is no more difficult than that involved in the chi-square test. In the opinion of the reviewer, it would have been better to have omitted the Yule "coefficient of association Q " (p. 46), which had appeared in the older book, and spent the space on an exposition of tetrachoric r ; for the latter has a simple interpretation, and, with the tables now available, its calculation is short and easily explained.

BURTON H. CAMP

Wesleyan University

The Methods of Statistics, an Introduction Mainly for Experimentalists, by L. H. C. Tippett. London: Williams and Norgate, Ltd. 1937 (2nd edition). 280 pp. 15s.

Tippett's book is so widely and favorably known that the following comments are devoted largely to a recital of some of the important respects whereby the second edition differs from the first. The revision is more than a nominal one as the book has been enlarged by some 57 pages.

The brief introduction has been rewritten. Chapters II and III of the first edition have also been rewritten and enlarged, comprising now three chapters entitled "Frequency Distributions and Constants," "Distributions Derived from Theory of Probability," and "Errors of Random Sampling

and Statistical Inference." A few proofs have been added in the first two of these chapters. New material is most prominent in the third and includes consideration of levels of significance and rejection and acceptance of hypotheses, standard errors of functions of statistical constants, determination of population value from sample (fiducial probability), choice of statistical constants, and method of maximum likelihood. The discussion of fiducial probability would be improved, in the reviewer's opinion, if the illustrative diagram were drawn to scale and perhaps also if it were shown how fiducial limits of p may be ascertained from

$$\chi^2 = \frac{(a - \frac{p}{q}b)^2}{\frac{p}{q}N},$$

thus enabling the limits of p to be computed for any desired N and for various confidence coefficients

The chapter on Goodness of Fit and Contingency Tables is essentially as before. That dealing with Small Samples includes a new section on the Neyman-Pearson L_1 test for use when there are a number of estimates of variance. This chapter no longer includes the chart of the t distribution for $n = 4$ compared with the normal distribution, a very illuminating graph for the student.

The chapter formerly treating of the sampling distribution of the correlation coefficient has been expanded to include regression constants. The discussion of intra-class correlation and that of correlation of ranks formerly included in the chapter on nonlinear regression are not included in the present volume. Chapter X, "The Further Theory of Errors and Principles of Experimental Arrangement" is greatly enlarged, having new portions concerned with economy in sampling, sampling from a limited field, the use of controls, and multiple factor experiments.

For the intermediate student this is a most valuable volume. Frequently, points which are elusive in Fisher's *Statistical Methods for Research Workers* are cleared up for the reader by Tippet because of more extended discussion, explanation, or illustration. There is, however, no adequate table of areas of the normal curve, no t table, no z (or s_1^2/s_2^2) table, and no table of χ^2 . For the actual use of the principles and methods discussed the reader must therefore refer to one or more other publications. Perhaps the author will append these tables in a later printing or edition and increase the usefulness of the book.

FREDERICK E. CROXTON

Columbia University

The Treatment of Clinical and Laboratory Data, by Donald Mainland. Edinburgh and London: Oliver and Boyd. 1938. xi, 340 pp. 15s. net.

This book has been prepared for the express purpose of aiding the clinician, untrained in statistics, in the evaluation of the significance of clinical and

laboratory observations when presented in small samples. In the main, the subject matter consists of the discussion and application of (a) the concept of chance deviations, (b) the chi-square test, (c) the analysis of variance, and (d) correlation and regression statistics.

The illustrative problems are well chosen and are representative of the majority of statistical questions which arise in medical research. The analytical technique employed is in general appropriate, although the author, perhaps for pedagogic reasons, seems at times to prefer complicated methods to simpler ones equally adequate for the practical purpose to be served. On the other hand, considering the general objective of the book, some parts of the discussion leave something to be desired. Clarity and thoroughness in the exposition of theory appear to decrease as the methods become more complex. Explanations of the ideas underlying certain procedures are often cut short and the reader is referred to other textbooks. As a consequence, only a person already acquainted with the subject can apply some of the procedures described with any degree of assurance as to their significance and limitations. In addition, the critical attitude of the author toward the clinicians who do not use statistical methods seems a bit overstressed in spots. There is a trace of inconsistency when, for example, after properly berating those who substitute "common sense" for statistical analysis, it is considered unnecessary to give any proof of the equation for the standard error of a mean because "the reader will note the *reasonableness* of the formula." [The italics are the reviewer's]

ANTONIO CIOCCO

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Report of Third Annual Research Conference on Economics and Statistics, June 28 to July 23, 1937. Colorado Springs, Colorado: Cowles Commission for Research in Economics. 108 pp.

The Cowles Commission, founded in 1932 for the purpose of encouraging research in the field of economic science through the application of mathematical and statistical techniques, present in this brief volume of one hundred and eight pages abstracts of conference and public lectures delivered at their annual conference in 1937. Abstracts of some thirty-nine conference lectures, compressed into about one hundred pages, outline the methods employed and indicate the principal findings reached, without any attempt at detailed presentation of all the analytical steps involved. This method of presentation does not make the perusal of the report easy for any but the expert reader, but for the most part the complexity of the subjects treated and the techniques applied are such as to limit its usefulness to the mathematically and statistically trained students of the social sciences.

It would be presumptuous on the part of this reviewer to attempt a de-

tailed evaluation of the findings presented in this report. Contributions to the theory of index number construction and probability are made in eleven of the abstracts. Questions arising out of the statistics of commodity and security price theory were treated by twelve speakers, with the mathematical aspects of utility analysis occupying the attention of most of the remainder. The conference abstracts conclude with a group of significant suggestions by Professor Schumpeter on the quantitative study of the trade cycle. Abstracts of three popular lectures by Professor James Harvey Rogers on "Some Lessons of Recent Money Policy in the United States," Dr. Thornton C. Fry on "Probability and the Telephone Plant," and Mr. Carl Snyder on "The Relation of High Profits to High Wages," are presented in the concluding half-dozen pages.

In his opening conference paper on "The Econometric Problem," Professor Harold T. Davis draws attention to the importance of comparing the periodogram of the log correlation function of an economic series with the periodogram of the function itself. An attempt to explore the random element in the movement of economic time series was made, and it was found that variations from the linear trend of rail stock prices over 21 overlapping periods from 1830 to 1930 were greater than normal variations.

In an interesting analysis of the relation of stock prices to the earnings of companies, Dr. Charles F. Roos found that the coefficient of variation tended to be less for highly priced than for lower priced stocks. As to the relation of stock prices to earnings, it was found that stock prices may fluctuate within wide limits for any given earnings or dividends position, with such external factors as monetary inflation, strikes, or social-reform legislation occupying a dominant role. A review of some leading formulae for representing cyclical movements induced by random causes is discussed. Professor Theodore O. Yntema, in his discussion of the security exchanges, mentioned the desirability of studying the regression between variables not associated with cyclical swings alone.

In the field of commodity price analysis, Professor Holbrook Working divided his research program into a study of the consequences of alternative pricing methods (regulation or free competition), a consideration of the theory of the general price level, and the behavior of commodity prices in the business cycle. Dr. Oscar C. Stine concluded with respect to farm prices that a knowledge of the price history of the commodity is of greater significance for the analyst than theoretical principles or statistical method. Mr. Louis H. Bean, in a suggestive discussion of the relation of the supply of agricultural products to industrial stability, indicated that the negative fluctuation of farm crops in response to lower prices exceeded their positive fluctuation in response to rising prices and that this inequality of price-acreage fluctuation was transmitted on an intensified scale to complementary industries.

Mr. Snyder reaffirms his position that changes in the general price level are directly responsive to changes in the volume of credit. He seems, however, implicitly at least to lend support to a study of particular prices in

cycle analysis, if one may infer as much from his observation that a severe depression (1907 is cited) may occur without a change in the general price level or in the volume of credit. In an interesting series of observations on the determination of commodity prices, Professor Theodore H. Brown makes the observation that "presumably the manufacturer can determine the number of units which he will supply and at the same time can set his price within wide limits." An explanation of this peculiar departure from the conclusions of economic theory is not provided.

Among the several lectures dealing with mathematical applications in economic theory, Professor Edward V. Huntington discusses the use of the method of postulates in the social sciences, and Professor Ragnar Frisch adapts the postulational device to his theory of the general choice-field. Following the postulational method of classifying observed systems according to their logical structure, Professor Huntington points out that, granted certain postulates regarding an economic system, conclusions may be reached as precisely in economics as in the field of applied science. Professor Karl Menger develops a theory of social relations based on the dissimilarities as well as the likenesses of individuals and groups. The theory would provide a basis for broadening the field of choice between different aims. In Professor Davis' second lecture, various attempts to deal with the measurement of utility, income, expenditure, and saving are developed. A selected bibliography on the theory of utility is provided. Dr. Jacob Marschak and Professor Gerhard Tintner also contributed lectures on the theory of utility.

The theory of variance and its application to two or more dependent variables, index number bias for various types of averages associated with different weighting techniques, and Professor Felice Vinci's derivation of a measure of the so-called external appreciation of money are other problems discussed and solutions offered.

In the abstracts of the three popular lectures which conclude this report, Professor Rogers places emphasis upon the dollar devaluation program of the Roosevelt Administration as a means of preserving a long-run cheap money policy. Dr. Fry comments on the usefulness of the theory of probability as a substitute for empirical study in the operational problems arising in the telephone industry. Mr. Snyder points to the parallelism between the mechanization of American industry, the amount of capital invested therein, and the rise in the rate of wages received by the American worker. He concludes "it is almost solely through the profits of industry that the new capital, and especially the new capital for new industries, is derived . . ." This being true the implications for current tax policy seem obvious.

Valuable as a report of this character is for one who would keep abreast of the work of the leaders in the field of econometric science, greater unity of purpose as regards the findings of the conference lectures would seem to be desirable.

O. J. McDIARMID

Carnegie Institute of Technology

Elements of Statistical Method, by Albert E. Waugh. New York and London: McGraw-Hill Book Company, Inc. First Edition. 1938. xv, 381 pp. \$3.50.

This textbook, according to the preface, was planned not with the idea of laying a foundation for statistical work in business, biology, or any other particular field, but rather "to introduce the student to statistical concepts and statistical nomenclature and to get him to think in statistical terms." This plan has been followed conscientiously and ably by Professor Waugh. Teachers whose courses are designed for similar purposes may well be grateful to him for a presentation which achieves exceptional clarity without sacrificing precision. Statistical concepts are explained in terms which can be readily understood by the nonmathematically minded, yet there is plenty of food for the thoughts of the abler student of mathematics.

The book begins with two short chapters entitled "The Nature of Statistics" and "The Meaning of Numbers," respectively. The content of these chapters would probably fail to justify, in the eyes of the thorough scholar, the implications of the titles. The first chapter contains a description of the "experimental method," an example of a problem which cannot be solved by that method, a very generalized statement of the purpose of statistical methods, and some "preliminary admonitions" concerning the dangers of trying to carry statistical methods too far. No attempt is made to present a rigorous definition of statistics, statistical methods, or the types of problems to which statistical methods are applicable; nor is there any sort of general description or classification of statistical methods. The chapter on "The Meaning of Numbers" is even more restricted in scope, being limited to a concise explanation of the concept of significant figures, with illustrative examples. Whether rightly or wrongly named, however, these chapters present plainly and forcefully some fundamental ideas which are extremely important to the beginner in statistics.

The third, fourth, and fifth chapters are concerned with frequency distributions and the statistical measures used in analyzing them; the sixth is given over to a discussion of probability theory, the normal curve, and moments. The concept of standard error and its application to various statistics is taken up in the seventh chapter; time series, regression equations, and index numbers in the eighth. The next three chapters are concerned with simple linear correlation, simple curvilinear correlation, and multiple correlation, respectively. The two final chapters deal with problems of "tabulation and graphic presentation" and "collection and analysis of data;" they are largely nontechnical in nature.

Throughout the book the exposition of statistical principles is aided by the presentation of well-chosen examples from various fields of statistical work. At the end of each chapter exercises for the student are presented. Some of these use hypothetical and oversimplified data, to aid in clarifying fundamental concepts without introducing arithmetical complications, whereas others are actual problems from business, economics, or science. As the author points out, most teachers will want to supplement these problems with a separate laboratory manual or with other problems taken from

the daily press and other current sources. Among the problems presented in the book, there is an unfortunate lack of the type whose solution involves a choice of method, or the fitting together of several parts of the technique expounded in the text.

The author has not attempted to include mathematical proofs and derivations for all of the formulae which he introduces. On the other hand, the presentation cannot be described as nonmathematical. It assumes a knowledge of college algebra and considers in some detail several of the simpler mathematical aspects of statistical methods.

It is inevitable that a presentation which purposely avoids emphasis on any one branch or application of statistics should fail to satisfy completely those who have special interests in a particular field. The teacher who adheres to the belief that a statistician cannot make effective use of tools the mathematical justification for which he does not understand will not be satisfied with Professor Waugh's technical treatment. The economic statistician is likely to be disappointed in the small space allotted to the problems of index numbers. The teacher of business statistics will wish for a more thorough treatment of time series analysis and will probably notice also that practically no mention is made of statistics as a means of control. The business statistician and the biometrician alike may wish that the author had seen fit to include some discussion of planned experiments and the methods of analysis applicable to them. These objections, however, may well be more than offset, in the eyes of many teachers of specialized courses, by the exceptional clarity of Professor Waugh's exposition.

It is a source of regret to the reviewer that it is necessary to teach courses in elementary statistics which avoid concentration either on the mathematical aspects or on any particular practical application. A group of students having widely divergent interests in the subject of statistics, or having very little interest of any kind in it, can hardly derive the same benefits from the study as a class which has a more or less definite and uniform purpose. That such mixed courses are a seemingly unavoidable part of the curriculum in many colleges is, of course, no fault of Professor Waugh. He has recognized the widespread existence of these courses and has provided a text, carefully planned and ably executed, to fill their needs.

S. B. STOCKING

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Harvard University

How to Use Pictorial Statistics, by Rudolf Modley. New York and London: Harper and Brothers. 1937. xviii, 170 pp. \$3.00.

In his book Rudolf Modley traces the history and development of the method of pictorially presenting statistical data, giving due credit to its founder Otto Neurath. Anyone interested in presenting data in graphic form, irrespective of the method to be used, would do well to read this book. The rules Mr. Modley lays down for building a pictorial chart also apply to

more formal types of presentation. He stresses simplicity and the fallacy of attempting graphically to present too many variables on one chart, and he does well to point out that the pictorial method is limited only by the complexity of the data. Methods of presenting various kinds of data are discussed and in most cases are adequately illustrated.

It is emphasized that symbols should be designed to speak in terms that are comprehensible and for this reason a symbol for a given subject should vary depending upon the specific audience in mind. "The American and the Chinese farmer dress differently and use different tools; the symbol for a farmer in America will, therefore, vary from the symbol for a farmer in China." After seeing some symbols used by Mr. Modley, I doubt if he has entirely alienated himself from the European influence.

The book fails to cover one very important factor involved in making pictorial charts. It is extremely difficult, at the present time at least, to obtain the services of an artist who has had training in this method of presenting statistics. Mr. Modley is undoubtedly aware of this problem, however, for he has made available various symbols (some are carelessly drawn, I believe) which may be purchased. Ready-made symbols, however, are not a solution. For effective presentation, each class of data must be represented by a particular symbol.

This book, insofar as the reviewer is aware, is the first of its kind and points the way to a method of presenting for popular appeal interesting material heretofore found only in technical publications.

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Studier över Tallens Fysiologiska Variabilitet och dess Samband med Klimatet, Ett Bidrag till Kännendom om tallens Ekotyper (Study of the Physiological Variability of Pine and Correlation with Climate, A Contribution to the Knowledge of Pine Ecotype), by Olof Langlet. Stockholm: Meddelanden från Statens Skogsförsöksanstalt. Heft 29, Nr. 4. 1936. pp. 219-406. Numerous text figures and a bibliography of 375 titles. In Swedish with a full German Summary.

This paper is another publication from the Swedish Forest Experiment Station that is well worth reading. The plant and tree physiologists will find it valuable as a contribution to the literature on the relationships between the physiological variabilities in plants (here *Pinus sylvestris* L.) and climate, both when planted in the place of origin of the seed and in other localities. Other scientists will find it a well-grounded, excellently prepared and presented piece of research.

The paper was Dr. Langlet's doctoral dissertation. The criticism which has previously been made that the research was based on dry substance in the plant and did not include some other lines of work does not, in the opinion of this reviewer, detract in the least from the value of the research.

Dr. Langlet summarizes in the first three chapters the work of many others on the subjects of: the provenience (locality) question development; physiological foundation of cold hardiness in plants; and the annual variation of different substances in the plant cells and the correlation between these substances and cold hardiness. From this previous work he concludes that his study shall be based on dry substance content in the plant.

The research covers the period 1928-35. Much of the work was done at the State Forest Experiment Station near Stockholm, where pine plants from seed from several hundred localities were planted. Some of the planting was done also in other parts of Sweden.

Analysis of the data in the fourth chapter, which covers the quantitative physiological differences between pine plants of different localities, leads to the following general statements: Plants of northern descent are characterized in fall and winter by a comparatively high dry substance content (in percentage of fresh weight), sugar (in percentage of wet weight), material extracted with petroleum ether (in percentage of dry weight), as well as catalase. At the same time these plants showed a lowering of the total nitrogen (in percentage of dry weight), but against that was found a higher content of "växttråd" (I translate this as plant fibers, since the author states that they are composed mostly of cellulose and lignin) (in percentage of dry weight), and substances extracted with weak acid and alkali (in percentage of dry weight).

Investigations on one-year-old pine seedlings and on needles from older pine trees indicate that the content of dry substance and sugar rises in the fall and is high during the winter but sinks in the late winter and early spring. Sugar content was found to be higher in one-year-old seedlings than in the needles of older trees.

Pine plants from northern stock showed a more or less intense winter coloring. This, in the leaves of older plants, and in the case of yellow coloration intensity, is proportional to the chlorophyll content of the leaves.

In dealing with investigations of pines from various localities, planted in places where there was a different climate, Dr. Langlet points out that the pines from the northern localities develop their needles earlier in the spring than do the trees grown from seed from southern stock. The time of development of the needles shows a strong correlation with dry substance content. That is, the higher the dry substance content, the earlier in the spring the leaves of the plants develop. Summing up these data, it is concluded that "dry substance content is a value easily arrived at and characteristic for pine plants from different localities. It indicates their physiological variabilities such as the overwintering ability, growth form, rate of growth, periodicity, etc."

In the study of the correlation between dry substance content and climate of the original home locality of the plants under investigation, meteorological maps were prepared showing the total number of days in a year with an average normal temperature of plus 6°C. or over; the average temperature of the warmest months; and the spread between the average temperature of

the warmest and coldest months. A statistical investigation of the data shows that the dry substance content of pines from a known region can be regarded as a function partly of the latitude of the locality, partly of the length of the vegetational period. In the latter case is meant the number of days per year with a normal average temperature of plus 6°C. or over. This number of days with an average temperature of plus 6°C. or over is for Sweden (with the exception of the west coast) a function of the latitude of the locality and its height above sea level.

In the final chapter, a combination of the forest planting results and the plant height which can be expected from the use of pine seed from various localities in different places has been projected in the form of three-dimension graphs. A diagram of this type permits a lucid exposition of the results of removing pine seed from one part of the country to another, in that the results of different combinations of places and seed localities can be directly compared.

THADDEUS PARR

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Social Saga of Two Cities, An Ecological and Statistical Study of Social Trends in Minneapolis and St. Paul, by Calvin F. Schmid. Minneapolis, Minnesota: Bureau of Social Research, The Minneapolis Council of Social Agencies. Monograph Series No. I. 1937. xvi, 418 pp. \$3.50.

In reading Calvin Schmid's book, one is reminded of the life of Loewen-hoek, the inventor of the microscope. Loewen-hoek, after having discovered a new means of observing and studying life, brought it to bear somewhat indiscriminately on all objects small enough to be put on the slides of his microscope. Likewise, Mr. Schmid has seemingly drawn into his ken every variety of social phenomena available in Minneapolis and St. Paul that would lend itself to statistical analysis. The result is a substantial volume of 218 charts and maps and approximately 200 pages of text presenting a panorama of the social and economic life of the Twin Cities in so far as they can be mirrored by the statistical techniques employed.

This wealth of information is grouped under four major headings: (1) the growth and expansion of the two cities; (2) the population trends; (3) housing conditions as portrayed from the data collected in the Real Property Inventory; and (4) a miscellaneous assortment of statistics dealing with social and personal disorganization. Very little of the data are presented in tabular form. Consequently, the text, which attempts to embrace an elaborate array of statistical information, is difficult reading. This difficulty is, to a certain extent, offset by the generous inclusion of excellent charts and maps, telling the general story of trends, distributions, and relationships with a high degree of effectiveness.

One is likely to read Mr. Schmid's study with mixed emotions. First of all, one is impressed with the meticulous care and thoroughness of the author

in presenting the many available data for the ecological study of an urban community. One is likewise impressed, however, with the significant gaps in the information. A number of important items are omitted apparently either because they were not available or because their inclusion did not fit in with the time and scope of the study. For example, there is very little if any reference to the volume of service rendered by public or private social agencies. This is doubly strange, inasmuch as the study was published by the Minneapolis Council of Social Agencies. Likewise, there is a very meager treatment of vital statistics, although these data are of the utmost significance in evaluating both the social and economic characteristics of the community as well as the attitude of the community in tackling its problems. These sins of omission can readily be forgiven because of the excellence in treatment of such data as are included.

The first part of the book, that dealing with the growth and expansion of the two cities, will probably be the most interesting and valuable to those readers not residents of Minneapolis and St. Paul. It includes a wealth of statistical and historical material illustrating the rise and development of the area. A great deal of space is justifiably given to the growth and decline of various occupations and industries. Considerable emphasis is placed upon the development and changes in the means of communication and travel. Particularly interesting is the chapter devoted to the study of the evolution of property uses in the various sections of the city, tracing the shifts in merchandising centers, the migration of hotels, churches, and theaters. The spread of the residential community from the original cluster of downtown sites to the present suburban areas is effectively emphasized with charts illustrating the development of streetcars and paved streets. The influence of the use of the automobile as a means of communication and travel is effectively correlated with the analysis of the expansion of the residential areas. Throughout this section the maps used to illustrate the author's thesis are excellent models in the graphic presentation of one of the most fascinating problems of urban life and one of the most difficult essays to show adequately.

The second section of the book is devoted to the analysis of the changes in the population by sex, age, race, nationality, and size of family. In this there is little that is novel or significantly different from the number of similar studies made of other urban communities. It is worth while to call attention to the treatment of one of these problems; that is, the distribution of the Jewish population based upon data available from a local housing survey. Any study which adds to the knowledge of this rather difficult and nebulous subject will be welcomed by the students of urban sociology.

The third section, which is devoted to an analysis of the Real Property Inventory of Minneapolis and St. Paul, contains one very important contribution. The inter-relationships of the various criteria used in the Real Property Inventory have been evaluated by the coefficients of correlation. Although the relationships discovered in this analysis may not hold true for other urban centers to the exact degree indicated in this volume, neverthe-

less they are sufficiently provocative to warrant similar analyses for other communities where the same data are available.

The fourth section, comprising the last 100 pages, is devoted to a rather miscellaneous group of studies including marriage and divorce rates, crime statistics, prostitution, venereal disease, and suicides. The treatment of these series contains nothing unusual either from the point of view of methodology or results, but they add greatly to the value of the book as a reference for the students of the area.

What Calvin Schmid has done is to carry out the ambition of most persons interested in the social research of a given community. He has embodied in one volume as comprehensive and as concise a statement as is possible of the variety of pertinent data that are necessary to picture the social evolution of an urban community. He is particularly to be congratulated for the skill with which he has incorporated the work of students in his classes and in turning the requirements for the fulfillment of the candidacies of a degree into a useful source book for the community.

RALPH CARR FLETCHER

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A Social Study of Pittsburgh, Community Problems and Social Services of Allegheny County, by Philip Klein and Collaborators. New York: Columbia University Press. Published for the Social Study of Pittsburgh and Allegheny County. 1938. xxviii, 958 pp. \$4.75.

This volume represents a comprehensive and scholarly appraisal of social work in the city of Pittsburgh and the remainder of Allegheny County against the geographical, political, economic, and social matrix of the community. It belongs to the type of study which has come to be known as a social survey, but it is not a sequel to the Pittsburgh Survey made almost three decades ago. "... the present study itself was designated a 'social study' rather than a 'survey' in deference to a persistent resentment of the activities associated with the famous Pittsburgh Survey, which laid bare some of the social costs of the precipitous pursuit of power and wealth" (p. 290). In comparison to the original Pittsburgh Survey, the present study is more even-tempered, objective, and thorough. Moreover, in its accuracy and completeness, its scholarly analysis and judicious weighing of the facts, *A Social Study of Pittsburgh* sets a very high standard indeed.

The study was initiated in 1934 by a local "Citizens Committee," appointed in equal numbers by the Federation of Social Agencies and the Community Fund. The Buhl Foundation provided a subsidy of \$85,000 for this undertaking, while many other local organizations, especially the Bureau of Social Research of the Pittsburgh Federation of Social Agencies, the Bureau of Business Research of the University of Pittsburgh, and the Pittsburgh City Planning Commission provided valuable assistance and

materials. This volume is fundamentally a cooperative effort. Throughout most of the work Dr. Klein was assisted by a large staff of able and experienced workers. Although many people have collaborated in organizing the material and writing the original chapters, the completed volume is thoroughly unified and clear, and fairly readable.

One of the most unique and significant characteristics of this study is the excellent analysis of the physical, economic, and social setting of community life in Allegheny County. Approximately one-third of the report is devoted to this phase of the problem, and the remaining two-thirds is concerned more directly with an evaluation of social work in Allegheny County. This phase of the study correctly emphasizes the importance of understanding the historical, geographical, political, economic, and social forces which have molded the life of the community as a prerequisite to an accurate understanding and interpretation of social work services. More specifically, Part I includes a general historical and descriptive survey of Allegheny County and its constituent communities; an analysis of the basic industrial trends, wages, employment, and unemployment in Allegheny County; a summary of progress in social legislation and labor organization; a study of housing conditions among the wage earning classes; an interpretation of the more significant characteristics of ethnic and racial groups; a socio-psychological survey of attitudes and public opinion, and a study of changes and trends in the public school system of Pittsburgh during the past quarter of a century.

In many ways the first part of this study is comparable to the recently published and well-known volume, *Middletown in Transition*, by Robert S. Lynd. *Middletown in Transition* is a survey of Muncie, Indiana, an industrial community very much smaller than Pittsburgh. The Muncie study covers a wider field but is more impressionistic and journalistic in style. It has a very broad appeal. On the other hand, the survey of Pittsburgh is more thorough and objective but less readable. Its appeal will be confined largely to the professional social scientist and social worker. Perhaps it would have been a real advantage—except for the cost differential—to have published Parts I and II of *A Social Study of Pittsburgh* in separate volumes. At the present time the study is somewhat forbidding in its make-up—the type is relatively small, the chapters are long, and the entire report comprises close to 1,000 pages. The social scientist will be very much interested in Part I, but it is very doubtful if he will read Part II. Of course, the social worker will be mainly interested in the second part.

As an illustration of the type of material in Part I, as well as some of its implications for the larger study, let us consider very briefly Chapter III on "The Chances for a Living in Allegheny County." This chapter is based on a special report prepared by Dr. J. P. Watson of the Bureau of Business Research. Of the twenty-one chapters that comprise the study, this chapter is one of the best. Although many of the facts and interpretations are tentative and the connection between the problems discussed and the demands which they create for social service are not always obvious, nevertheless this

chapter as well as all the other chapters in this section represent an excellent analysis of the economic and social life of this community.

During the past decade or more the opportunities for employment in the Pittsburgh area have definitely lagged behind the growth of population.

Data on the activities of the State Employment Office and thirteen private employment agencies show convincingly that in Pittsburgh the ratio of the number of jobs to the number of applications for jobs was falling drastically long before 1929. It was the opportunity to work, not the willingness to work, that dried up—and that was in “good” times (p. 118).

It is further pointed out that in 1929 when employment conditions reached the highest level known, approximately 5 per cent of the workers were without employment. The lowest level of employment occurred in March, 1933, at which time close to 40 per cent of the workers were unemployed.

The Pittsburgh district had a period of very rapid industrial growth in the latter part of the last century, but in recent years the rate of growth has slowed down to such an extent that the district has the appearance of practical maturity. The district has been known as a production district. The trend of production and the trend of population have become more and more nearly parallel, but with the recognized growth of efficiency of production, a parallel between the trend of production and the trend of population means a decline in work per capita in the production industries.

As far as certain types of industries are concerned, some have increased in relative importance, some have settled toward a level, while others have declined. In this connection we find that the index of total iron and steel production in the Pittsburgh district was only a little higher in 1929 than in 1916 and that coal production reached a distinct peak in 1918 and has since noticeably declined.

In addition to the analysis of unemployment associated with the trends in production and changes in basic industries, as well as with the business cycle, consideration is also given to seasonal fluctuation in business as a factor in the irregularity of work.

Although employment is of utmost importance in the economic well-being of the worker, there is also the question of sufficient earnings. Does the worker earn enough during the periods of actual employment to provide a reasonable average income over the year? How many others besides himself depend upon the worker for support?

It must be clear to the most reluctant observer of these figures that poverty is rampant in the industrial environs of Pittsburgh even in what we have called normal times: that poverty by whatever name we choose to designate the frequent occurrence of economic distress in the working population is the chief social problem of life; that it necessarily confronts the community, not only in the direct need for assistance, but also in distressing conditions of housing and health, in precarious morale, in subversive social attitudes. (p. 156).

Part II of *A Social Study of Pittsburgh* is devoted directly to an analysis of social work. Because of limitation in time and budget as well as for practical considerations, certain phases of social work were arbitrarily omitted,

for example, courts (except the Juvenile Court), penal institutions (except certain ones for children), employment services, the problem of the handicapped, the technical aspects of mental hygiene, and the pastoral work of churches.

This section of the study includes analyses of the following questions: the cost and support of social work; the planning and co-ordination of social work; the personnel of social agencies and the facilities for professional training; the general problem of relief, social case work and the characteristics and policies of agencies providing relief; the problem of personal adjustment as a task of social agencies where economic dependency, if present, is not the principal difficulty; social work for children; the organized care of the sick and public health administration; and facilities and programs for leisure-time activities. An "Epilogue," written a year and a half after the completion of the field work, constitutes the final chapter of this volume.

A summary of the principal recommendations presented to the Citizens' Committee are to be found in Appendix B. The essential phases of the recommendations, as well as occasional selected details, have been incorporated in the report in the various chapters and divisions of dealing with the several subjects of the inquiry. The recommendations are of course in varying degrees subjective.

Facts do not always lead to one conclusion alone; recommendations are compounded of opinion, as well as of facts, and opinions may differ; expertness of opinion is conditioned not only by the specialist's previous experience, but also by the acceptability of his recommendations to the interested party (p. 878).

From the 10 pages of closely printed recommendations, let us select a few for special examination:

Admission of Negroes to all hospitals and sanatoria on equal basis with white persons.

Transfer all hospitals from present city and county authorities to new Department of Hospitals, except control of contagious disease hospitals by Health Department.

Extend the inspection and licensing power and duties of the State Department of Public Welfare to all hospitals, maternity homes, institutions for chronic patients and convalescents, clients and out-patient departments, whether conducted under public, philanthropic or profit-making auspices.

Recognize that relief must become, and to all intents and purposes is now, a public function . . .

Establish a general nonsectarian case work agency for Pittsburgh and Allegheny County. The functions of the Family Society, Children's Service Bureau and the Children's Aid Society, would be transferred to this organization. These three agencies would then cease to function and would transfer their physical property and personnel, with the exception of executives and board members, to the new agency.

Create a County Department of Public Assistance with complete responsibility for all matters of relief, indoor and outdoor.

Administer all categorical relief through appropriate divisions within this department and transfer to it the Mothers' Assistance Fund, Blind Pensions, and Old Age Assistance.

As Dr. Klein points out, there is a deep-seated series of paradoxes which complicates the logical process from fact to conclusion and thence to recom-

ment and acceptance Will there be a serious attempt to follow at least the more important of the recommendations of this study? Many of the recommendations propose far-reaching changes—the merger and even the discontinuance of some agencies, changes of policy, modification of programs, new orientations, and the elimination of one function and the assumption of another Of course, many agencies will attempt to discredit the findings of the study and strongly resist any attempts to carry out certain of the recommendations Although only a brief time has elapsed since the completion of the study, several of the recommendations by the agencies affected have been accepted and decisive steps have been made for putting them into effect. What the ultimate result will be one cannot possibly predict. Nevertheless the study itself is a genuine contribution to social work administration not only in Allegheny County but throughout the country, and the conclusions and recommendations represent a real challenge to the present programs and concepts of social work

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Man and Society, A Substantive Introduction to the Social Sciences, edited by Emerson P. Schmidt. New York Prentice-Hall, Inc , 1937 xv, 805 pp. \$5.00.

Written as an introduction to social science for the college orientation course, this volume is reviewed here from that point of view. The work is divided into sixteen chapters as follows

1. Sociology and Culture, Elmo D. Monachesi; 2. Social Institutions, J. O. Hertzler; 3 Social Anthropology, Wilson D. Wallis, 4. Social Psychology, Herbert Blumer, 5. Psychology and Some of Its Applications, Howard P. Longstaff; 6 Modern Criminology, George B. Vold, 7. History, Lawrence D. Steefel, 8. Human Geography, Richard A. Hartshorne, 9. Elements of Political Science, Evron M Kirkpatrick, 10. Popular Participation in Government, Joseph R Starr; 11 The Machinery of Government, Joseph R. Starr; 12. The Economics of Price, Emerson P. Schmidt, 13. The Distribution of Income, Emerson P. Schmidt, 14 Economic Security, Emerson P. Schmidt; 15 Causal Relationships and Their Measurement, Richard L. Kozelka; 16. Social Valuation, Mary J. Shaw.

The reviewer believes that *Man and Society* is a good book in its field. It compares favorably with the best books now available for use in orientation courses to social science. The subject matter of the book is not as inclusive as one would desire. There is very little material on education, religion, recreation, art, and the family. These subjects should either have been treated as separate social science fields or at some length under sociology or social institutions. Since education is an extensively developed field, it probably merits a separate consideration.

There is no uniform approach to subject matter in the major divisions of the book. Consequently, the reader cannot predict which aspects of a given

subject will be treated. Three examples of this will indicate the point. First, each field is defined, except economics. Second, there may or may not be a discussion on the applied phase of a given subject. Third, in each field except history, the author deals extensively with the facts and theories of the field. The author of the chapter on history has omitted the facts and the theories, even though the preface to the volume states that: "The aim of the present volume has been to acquaint the reader with the core of knowledge in each of the social sciences" (p. v).

A number of inadequate theories are stated in various places. The chapter on "Psychology and Some of Its Applications" contains various mistakes. Three of these are cited here. First, the author claims that he "... adheres to the opinion that intelligence is relatively impervious to environmental influence . . ." (p. 238). After this claim, he discusses the researches which support his view and omits several studies which do not support his view. A second mistake, which is related to the first, is the belief that research evidence has accumulated which indicates racial differences in intelligence. Several uncritical studies are presented in support of this theory (pp. 240-41). Finally, the author accepts "dysgenic" family histories, such as the Kallikak, without any question of their validity (pp. 242-44).

One additional matter calls for special attention. In the chapter on economics, one will not find anything which approaches an adequate discussion of capitalism and the problems associated with it. This important subject is treated superficially. In the chapter on "Economic Security," the author considers "attempts to improve economic well-being and to create greater economic security for specific groups" (p. 637). No reference is made to a comprehensive and systematic form of social planning.

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A Manual of Archive Administration, by Hilary Jenkinson. London: Percy Lund, Humphries & Company, Ltd. 1937. New and Revised Edition. xvi, 256 pp.

The last five years have witnessed a notable expansion of archival activity in the United States. The establishment and rapid development of The National Archives; the erection of the Maryland Hall of Records and a new building for the Illinois State archives; the far-flung activities of the Historical Records Survey of the Works Progress Administration in inventorying and improving the condition of State, local, and church records; the Survey of Federal Archives outside of Washington (another W. P. A. project); and finally the organization of the Society of American Archivists, with a membership of over 250, are incontrovertible evidence that archival economy, or "archive administration" as Mr. Jenkinson calls it, is at last being domiciled in the United States.

It behooves the American archivists and would-be archivists, of course,

to familiarize themselves with the principles and practices of archival economy that have emerged from over a century of European study and experience, but unfortunately many of them cannot read with facility the systematic treatises on the subject that are available in various Continental languages. Jenkinson's *Manual*, the only work of the sort in English, was first published in 1922, but it has been out of print for a number of years; and this new and revised edition will receive a hearty welcome in all English-speaking countries. As an Assistant Keeper of the Records in the Public Record Office and as Reader in Diplomatic and English Archives in the University of London, Mr. Jenkinson is in close touch with English experience, and he has evidently made a considerable study of the Continental literature.

The book is divided into four parts and a number of appendices. The first part is devoted largely to a discussion of the nature of archives, which leads to the conclusion that "A document which may be said to belong to the class of Archives is one which *was drawn up or used in the course of an administrative or executive transaction (whether public or private) of which itself formed a part; and subsequently preserved in their own custody for their own information by the person or persons responsible for that transaction and their legitimate successors*." The second part deals with the "Origin and Development of Archives and Rules for Archive Keeping" and contains detailed suggestions for the physical care of records, for organizing and arranging the groups or classes in such a manner as to preserve their integrity, and for the making of guides, descriptive lists, calendars, and transcripts. Parts 3 and 4, entitled "Modern Archives" and "Archive Making," are devoted largely to a consideration of the archival problem involved in the enormous quantities of records that are now being preserved. The author feels that it is the business of the archivist to preserve records, not to destroy them, and that the solution of this problem must be sought in the prompt destruction by the agencies concerned of material deemed useless for administrative purposes without regard for its possible future value for historical or other scholarly purposes. There can be no question that the archivist alone cannot solve this problem, but it would seem that some consideration should be given to extraneous values. If only records having permanent administrative value had been preserved in the past, much of the most valuable archival material would not now be in existence.

Valuable as it is, the book does not entirely meet the needs of American archivists. The principles of archival economy may be universal, but their application varies with the varying character of records of different periods and countries. Archivists in the United States rarely need to know how to care for mediæval rolls, but they frequently need to know what to do about enormous masses of raw data such as census schedules and replies to questionnaires; they seldom have occasion to clean and repair parchments, but they need information about efficient and inexpensive methods of fumigating, flattening, and rehabilitating vast quantities of modern papers. A manual

of archival economy designed to meet these and other needs of American archivists is a desideratum. Doubtless it will appear in the fullness of time.

SOLON J. BUCK

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Group Hospitalization, A Report Prepared by the Bureau of Medical Economics, American Medical Association, Chicago, Illinois, 1937, 296 pp.

The report opens with a brief review of the background of group hospitalization plans in which these schemes are distinguished from the traditional fee-per-patient methods of payment for hospital services. Then will be found discussions relative to a distinction between industrial health services and medical service systems, the beginnings of hospital plans, the British contributory and provident hospital schemes, and the essential characteristics of these forms of insurance. The forces behind group hospitalization are next considered, and the primary motive is found to be, strangely enough, not a response on the part of the hospitals to the need of the public to guard against the unforeseen necessities of expensive hospitalization but rather "the bolstering of hospital finances" (p. 30). The study does find, however, that "the promotion of bona fide group hospitalization plans also had the desire to furnish hospital facilities on more equitable payment arrangements for patients with limited means" (pp. 30-31), so public demand is found to be a factor in this development, although not the most important one.

Next a record of "principles and approvals" of such plans is set forth presenting attitudes and official action of such medical bodies as the American Hospital Association, the American College of Surgeons, and the American Medical Association. The last-named body, so the reader is told, through the *Journal of the American Medical Association*, carefully discussed the pros and cons of hospitalization insurance schemes and "listed fifteen prospective defects as against four merits of such plans" (p. 33). The way in which organized medicine may judiciously guard against the pitfalls of any plan that smacks of "medical insurance" is cleverly suggested in this discussion by a reproduction of a resolution adopted by one state association. The last paragraph of this "example" reads.

"Therefore, the Council recommends that any component society of the . . . State Medical Association refuse sanction to any hospital insurance project until complete study has been made by the county medical society, and until pertinent data have been submitted to, and acted upon, by the Council of the . . . State Medical Association" (p. 39).

This growing interest in group hospitalization finally impelled the House of Delegates of the American Medical Association to set forth, in 1934, ten principles which this body felt should govern experiments for organizing medical and hospital services. The report hastens to add that although

"these principles have been lightly referred to as the 'Ten Commandments' of the American Medical Association," nevertheless "their usefulness and importance have been demonstrated" (p. 40). No concrete evidence, however, can be found in support of this claim.

The statistical part of the report in which 16 tables are presented sets forth the result of a survey conducted between October, 1935, and March, 1936, when every locality in the United States where a group hospitalization plan was thought to be in existence was presented with a series of letters and schedules. Of the 199 organizations upon which information was available, only a few were in operation and reported sufficient data to be usable, so the analysis of necessity is largely a case study analysis. This part of the study, in the mind of the reviewer, represents a helpful contribution to the literature in this field so far as it describes objectively the organization, administration, financial policies, sales and promotion programs, hospital benefits and rates of charges of typical plans, and presents an analysis of the growth in membership of the various schemes.

The study then passes on to a consideration of the relationship of group hospitalization to the practice of medicine in which the interest of the doctor is stressed as being of fundamental importance to all types of health and hospital services. A note of warning is here sounded inasmuch as all group hospitalization plans "place hospital service corporations in control of the services of individual hospitals and interfere with medical practice in hospitals," thus leading to undesirable practices such as "the solicitation of patients, the entrenchment of nurse anesthetist, the placing of more and more of the practice of radiology in the hands of incompletely trained lay technicians, and the forcing of pathology from its rightful position in the practice of clinical medicine" (p. 199). A continuation of these practices, it is thought, will soon subjugate the medical profession to the dictates and control of hospital service corporations, and this will inevitably lead to the destruction of the professional practice of medicine. "Hospitals are entirely dependent on physicians and should strive to serve them by offering improved facilities and educational opportunities to better their skill. To attempt to control or to employ physicians will lessen their initiative and self-reliance and will adulterate the quality of the service they render" (p. 200).

After a brief comparison of accident and health policies with group hospitalization contracts, the book ends with the general contention that "group hospitalization is neither a simple, direct method of paying for hospital bills nor a solution to the economic problems of hospitals and patients alike" (p. 230), and a postulation of "principles" in which the traditional selfish claim so often repeated is once again restated "the decision as to whether or not a group hospitalization plan is essential must rest primarily with the medical profession and the hospital officials of the local community" (p. 246). Lest the public citizen should by happenstance think that his voice were worthy of some recognition in the solution of this important problem of medical costs, the case for the American Medical Associ-

ation is clinched by a full recitation of the "Ten Commandments" (pp. 247-48), and a reminder that the House of Delegates of the American Medical Association is a democratic organization and has called particular attention to the "Fourth Commandment" which says that "the subscriber's contract shall (should) exclude all medical services—contract provisions shall (should) be limited exclusively to hospital facilities" (p. 247)

It is extremely difficult to appraise objectively a work that is so lacking in objectivity. The report has "an axe to grind"—it is in defense of private medical practice and organized medicine, and the "grinding wheel" is in motion throughout most chapters of the book. The pattern of the report is not clearly set forth, it is difficult for the reader to gain an idea of the scope and method of presentation—but its general purpose cannot be missed. Many statements are set forth without supporting evidence; many others fail to carry the necessary references which permit further checking. (Cf. pp. 10, 11, 12, 30, 31, 147, 149, 154, 159, 162, 163, 165, 191, 206, 235, 238, 241, 242, 243, 244, 246, 249)

In other cases certain data presented cannot be relied on. For instance on page 13 it is stated that "it was found that the cost of practicing medicine in private practice varies from 27 to 34 per cent of gross income," et cetera, when in fact one of the most comprehensive studies yet made for any state has shown the ratio of gross income devoted to expenses during 1933 to be 45.4 per cent (California Medical Economic Survey, 1937, p. 106). Again (p. 14) the American Medical Association is given as partial authority for the statement that "the claimed economies of group arrangements do not seem to materialize, because, in spite of uncertain accounting methods, the reported cost per student is not *appreciably less* (italics the reviewer's) than the cost for similar services in the private purchase of medical and hospital care." This statement is made in spite of the fact that the United States Department of the Interior, Office of Education in its *Student Health Services in Institutions of Higher Education*, Bulletin No. 7, 1937, offers numerous specific cases to the contrary.

Another serious defect of the work relates to the statistical analysis of the various hospitalization plans. In this analysis, comparisons are made throughout upon a basis of the *number of plans*, although one of the tables presented (Table 8, p. 91) shows that the membership of respective plans varies all the way from 118 to 216,195, the largest three plans accounting for almost half of the total membership of the 49 plans upon which information was available. Also some inaccuracies of statistical comparisons are to be found (cf. last sentence in the first paragraph on p. 105).

Open to most severe criticism, however, is the evaluation presented throughout the report relating to the basic principles of insurance (found especially on pages 146 to 159, and 241 to 249). In analyzing the cost of hospitalization schemes to the subscribers the authors argue.

"For the subscriber, the plan offers one hospitalization at \$50 in return for \$90 collected in premiums. On the basis of anticipated hospitalization experiences, it is expected that each subscriber will be hospitalized once in ten years. From the financial point of view, an income of \$90 (\$9 annually

for ten years) is received from each subscriber, in return for which the expenses of one hospitalization are expected to be paid. The cost of this hospitalization is, as reported, about \$50. The difference of \$40 is for administration, promotional expenses and reserves."

So it is demonstrated how much better off the subscriber would be to remain out of the scheme and experience only the *average* hospitalization costs. But he is not told how to choose his hospitalization needs so that these *average* costs will be all that he needs at any one time, or during any given period.

Is there any reason to be surprised at the lack of understanding present within the medical profession as long as this type of propaganda is issued? There are sound advantages as well as weaknesses in a system of hospitalization insurance. Both sides need objective analysis. This work, as might be expected, represents an attempt on the part of organized medicine to emphasize the shortcomings and dangers of group budgeting plans for hospital care, and failing this, at least to point out the necessity for such plans to be under the constant vigilance and control of the medical profession. It is another in the long series of free publications of the American Medical Association circulated in defense of privately organized medicine.

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HOW TO STUDY THE SOCIAL ASPECTS OF THE DEPRESSION*

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DISTINCTIONS AND DIFFERENCES.—The use of the definite article “the” before the singular noun “depression” instead of the indefinite article “a” or instead of the plural noun means that the discussion is limited to the recent unlamented unpleasantness of 1930 to 1935; it means that we are not interested in the social aspects of depressions, we are to discuss the way to make a case history study of a single though infinitely complex, instance. Pushed to the extreme this is an attitude often found in the medical clinician who says that no two cases are ever alike or in the historian who says that history never repeats itself and that analogies are misleading. There is much to be commended in this point of view. It is perhaps better justified in the sociologist who does not have the length of life to see several major depressions than in the clinician who does see a large number of cases of the same disease. Furthermore, even if the sociologist should develop, as G. B. Shaw urges for statesmen, in *Back to Methuselah*, a normal life span of 300 years, he might well contend that technology so changed in the long intervals from depression to depression that he must admit the validity of the historians’ contention that the instances were indeed non-comparable.

The insertion of the article “the” before “social aspects” instead of its omission, implies on the other hand that we are interested in the whole complex of social aspects of the depression. This complicates our problem by introducing the “total situation” with all its unsolved methodological difficulties. Finally, whether the adjective “social” is intended to restrict or to amplify the noun “aspects,” and in what way, is not clear. In the Foreword to the thirteen *Studies on the Social Aspects of the Depression* the monographs are described as a series designed “to stimulate the study of depression effects on various social institutions.” This is, at least in form, a more specific statement. It implies that we are interested in some degree of generalization,

* The opening paper at a joint session of the American Statistical Association and the American Sociological Society, Atlantic City, New Jersey, December 30, 1937. The subject of discussion was the experience of the authors of a series of monographs on “Social Aspects of the Depression” (See p. 614.)

for "depression effects" means just that as contrasted with "aspects of the depression," and "various social institutions" is by no means synonymous with "the social aspects." We have a greater emphasis on causative relationships as contrasted with descriptive accounts and this introduces the very serious methodological point of the disentanglement of causes in a complex field.

I do not mean to imply any confusion on the part of writers or editors in the contrast I have drawn between the phrases "the social aspects of the depression" and "depression effects on various social institutions." It is not unlikely that one good initial step in the stimulation of the study of depression effects on various social institutions is a series of monographs on the social aspects of the depression. I wish merely to point out that there is a distinction and that I may have something to say about each of the problems thus distinguished.

The literary attack.—If we are interested chiefly in the social aspects of the depression as a case study we may perhaps best proceed as the Lynds do in *Middletown in Transition*. They visit the place, talk with some large number of various persons, and compose a breezy and highly readable book. This is not science, any more than the *Charge of the Light Brigade* was war; but both have a magnificence which increases the *élan* of a wide variety of persons, whether poet or peasant, whether professional or proletarian. And it is a study. Indeed it would have been a study even had the Lynds stayed at home to write it. I should not be surprised if time should prove that the best single study of the social aspects of the depression were to be found in some inspired novel or play. Let none say that such are not studies simply because the authors have not the doctorate and do know how to write. Until the social field is better surveyed and better schematized than at present one may find as good politics in Aristophanes as in Plato, as good sociology in Dickens as in Spencer.

Even in the economic field something may be garnered from highly inspired literature. You are familiar with the epic put together by an ancient unknown writer recounting the deeds of a dreamer who was sold down into Egypt and who had such insight into the ways of God and of men that he foretold a long cycle of fat and of lean years so effectively that he was advanced to the position of Secretary of Agriculture to one of the Pharaohs, whereupon he developed plans for an ever normal granary that must hold the admiration of our own Secretary thereof and furthermore carried out the plan with a completeness which may well be envied. He did not plough under the grain of the good years but stimulated its production and laid upon all farmers a special levy of 20 per cent of their production which he stored in ware-

houses distributed throughout the land until they bulged with the excess of the fat years. And when the lean years came he fed the people of his own adopted country and of others. He did not feed them for nothing; he made them pay. First he got all their money, then all their horses and flocks and herds and asses, and finally all their fields so that the land became the Pharaoh's. After this he resettled the people in the cities, perhaps to take their labor for public works in return for their food. So when at length the last lean year drew to its close and he came to issue them seed that they might sow the land which was now the Pharaoh's he laid upon the grateful if impoverished people the condition that one fifth of their harvests should forever belong to the Pharaoh—that was one social consequence of that depression, the people had become bond servants of Pharaoh. From some remarks I have recently seen attributed to another and different Joseph I should judge that Professor Davis is not of the group who is sure history does not repeat itself. At any rate one might inquire whether a temporary economic reliance of a people upon government usually results in a longer loss of liberty or even in a loss of a desire for freedom.

The informational attack.—I would not imply that all writing is to be extolled as worthy of serious attention. I said inspired writing, albeit I should have difficulty in formulating precise criteria of inspiration. You will recall that of the Athenians at the time when St. Paul was led into the Areopagus it was written (Acts: 17, 21): "For all the Athenians and strangers which were there spent their time in nothing else but either to tell or to hear some new thing." On the fourth day of these meetings at Atlantic City you surely will not begrudge me that quotation. I could say as much were I with the American Association for the Advancement of Science at Indianapolis. Of the many contributions there or here few are at this time contributions to science; they are too new. Science consists of the old things, of things old enough to have become accepted into a corpus of demonstrated knowledge and available as valid working hypotheses for further coherent developments. It is as difficult for the new to enter into science as it is for the *nouveaux riches* to enter into the Kingdom of Heaven. I would not be interpreted as slandering the Athenians or moderns as mere gossipers. The search for the new, the wonder at the unknown, the interest in the half known are such basic drives that they may well be classed with the "residus." Without them there would be no science and no revision of science. As close students we tend to overelaborate detail and to overexpand systematization, and thus to retreat from reality. It is the strange new things which we may tell or hear that serve as *apéritifs* to study and as *aperients* for overstudy.

This may all seem quite frivolous. It appears to me, however, that possibly there may inhere in some such liberal view as I have adumbrated a really meritorious suggestion as to the different methodologies which may be appropriate to the studies which attempt to understand the "total situation" as contrasted with those which attempt to add to our strictly scientific knowledge. Can a strictly scientific characterization of a "total situation" be expected to be attainable? May we not have forever to be content with an understanding of the sort the artist has and may not the best representation of a total situation be some sort of picture, more or less subjective, with large tolerances as to detail and even with certain poetic licenses to distort detail if it so be that the picture as a whole will thereby give a truer impression of the "total situation?" May we not have here some valid analogy with *diagnosis* in medicine. It is, I suppose, a well accredited fact that the good physician often makes a good diagnosis before knowing why or how he makes it. Diagnosis may not be so much a scientific as an artistic procedure, but if by the accumulation of experience one can arrive with reasonable correctness at a result, i e, if different persons arrive independently with reasonable unanimity at an agreement as to the essentials of a total situation, may not that consensus be itself as good a basis as any other for the validity of the result? The subject is too much to handle here,—I merely wish to raise it. Should not a number of Lynds do *Middletown* and the Lynds do a number of *Middletowns*? A physician sees numerous cases and consultations of physicians on a case are not unknown.

The handbook attack—After dwelling so long upon these literary or even gossiping methods which are so dear—and peradventure so necessary—to the social sciences that one may not proceed without paying them their due homage, I may suggest another attack on how to study the social aspects of the depression. If I would study the epidemiology of measles, as I am doing in such odd moments as are left me after satisfying the most pressing importunities of persons who would dissipate my energies over all sorts of interests personal to them—such as this program—if I would study anything, my first reaction born of some considerable experience in a variety of fields is to consult the best handbook or encyclopedia upon the subject. So in an effort to get a flying start on the serious part of my paper for this symposium I instinctively reached for the index of the *Encyclopedia of Social Sciences* by Seligman, the Rockefeller Foundation, Alvin Johnson, *et alius*. Therein I found in small type "Depression-Economic—see *Crises*. This gave me a bit of a depression. I had innocently supposed that depressions were sufficiently striking phenomena to be

worth a factual treatment all their own. Moreover, if the topic of this conference were depression as a cause of social effects I did not see much hope in a discussion of depressions as the effect of economic log-jams. I felt as though, being interested in anemias, I had turned to a medical encyclopedia and found the direction *see hemorrhage*—that is one way to become anemic.

However, there was nothing to do but follow the lead. So I looked up *Crises*. There was reference to the chief article *Crises* by Jean Lescure in 7 columns. Here was found plenty about Crises but little about depression. It was stated that crises have become of diminished acuteness and finally that "for the term crises one may henceforth substitute that of depression." I was of course glad of the implication that the late depression was less acute than former ones and thus lets us look forward with hope toward the next, but I wondered why if we should replace the term crises by that of depression, the Encyclopedia had not taken the hint. Next there was a reference to the second column of a 28-column article on *Business Cycles* by W. C. Mitchell which is naturally a very fine treatment of business cycles but quite appropriately not particularly informing about depressions for my purposes. Then there followed several references to economic theories of crises with special emphasis apparently on those of Marx which were not very helpful to me as I was not looking for opinions but for facts. There was a reference to Clement Juglar "who in 1862 first demonstrated the rhythmic cyclical character of economic activities" and one to Jean Charles Léonard Simonde de Sismondi "who in 1819 emphasized the fact that general crises are . . . an inevitable periodic concomitant of the prevailing economic structure." Clement Juglar or Simonde de Sismondi, take your choice, but for light on depressions you might as well be referred to Simone Simon—she might really help.

A stubborn fact—So I gave up the Encyclopedia of the Social Sciences as a useless and contradictory statement of opinions without factual backing. What to do next? My confidence in encyclopedias, (of mathematics, physics, engineering, medicine) which had become so firmly established in my various efforts at study was now so rudely upset by my present experience that I suffered one of those frustrations you hear about. In this moony state of bewilderment I chanced to think of an annoying fact of my wife's experience which according to her statement has a certain degree of general validity, and that fact was that with anywhere from 2,000,000 to 12,000,000 persons unemployed it has been particularly difficult to get and keep a maid. Is this a social aspect of the depression? The employment offices and all her friends answer that it is. Then I recalled a talk early in the depression with

my old friend John Candler Cobb who said that he was long since retired from business and was not *au courant* with affairs but that he somehow did feel (note the diagnosis and not the scientific inference) that prosperity was not just around the corner but that we were in for a real depression such as he recalled in the 1890's and even in the 1870's. He said that in those days, as they got worse and worse, people would come looking for work, begging for work, just for their keep, and that perchance this depression might relieve the serious problem of domestic servants. Did it? And if it didn't, but if on the contrary the problem grew worse, was that a depression effect on a social institution or was it the effect of a governmental policy itself arising out of the depression? And next, is a social aspect or effect of a governmental policy arising in a time of depression a social aspect or effect of the depression?

The statistical issue—The answer to the questions just raised throws us into matters of methodology. It involves the conceptual schematization which we adopt. If the aspects a_1, a_2, a_3, \dots are functions of certain variables v_1, v_2, v_3, \dots which are themselves functions of certain depression indices d_1, d_2, d_3, \dots as

$$a_i = f_i(v_i), \quad v_j = k_j(d_k), \\ i = 1, 2, \dots, p, \quad j = 1, 2, \dots, q, \quad k = 1, 2, \dots, r$$

these variables being partly known and partly unknown (or maybe not even suspected) and the known ones being partly measured and partly not measured, shall we say not only that the a 's are functions of the v 's and that the v 's are functions of the d 's but also that the a 's are functions of the d 's—in other words may we substitute and get

$$a_i = f_i(h_i(d_k)) = g_i(d_k), \quad i = 1, 2, \dots, p, \quad k = 1, 2, \dots, r$$

thus eliminating the v 's? This is ordinarily possible and often done in those realms of science like mathematical physics (including mathematical astronomy) which are often taken as the prototypes of all scientific thinking. We should not overlook the fact that such formulation is not stressed and may be inappropriate in systematic botany or zoology, in organic chemistry, or in medicine, and we may recall that Marshall emphasized the opinion^{*} that biology offered a far fairer analogy than physics to economics. In those cases where there is real variation in the data and where resort to statistical procedures seems inevitable we do not have the possibility of elimination by substitution. Even in the simplest case of only one variable we have linear regression equations:

$$a = lv + m, \quad v = pd + q \quad \text{but not} \quad a = lpd + lq + m.$$

The reason for this is that the left hand side of a regression equation contains not the variable usually written there but its mean value in an array. We should write

$$A = lw + m, \quad V = pd + q$$

where A , V designate array means of a and v , and in that form one would not be tempted to try to substitute. It is of course possible to write $A = rd + s$ but r cannot be calculated from l , m , p and q , it must be calculated independently.

We are entirely at liberty to adopt a conceptual scheme if we choose which relates the a 's to the d 's or one which relates the a 's to the v 's either with or without one which relates the v 's to the d 's. It does however make a great difference in our final product according to which scheme we do adopt; it also makes a difference in our statistical procedures in case we try to study the matter of depression effects on social institutions by the statistical method. We are presumably all aware of this fact; if we are not, we may study Sewall Wright's papers on his method of path coefficients which have the great merit of making it apparent how seriously the results depend on the schematization adopted. I would not imply that the state of most problems regarding social aspects of the depression is as yet such as to make profitable the attempt to apply to them Wright's method of path coefficients; I wish merely to suggest that until a problem reaches a state where such analysis is valuable we may do well to bear in mind the fact that the problem is not yet in that state.

Envoi —The very self-sacrificing persons who were good enough to devote a considerable fraction of their energies and intelligences for a long period of time to the preparation of the thirteen monographs on *Social Aspects of the Depression* found, as they frankly admitted, many difficulties which they tried in many ways to turn and which in some cases they did turn with a greater ingenuity than could have been expected even of them. And when they could not turn the difficulties they were often successful in saying how information might be collected which should make it possible to overcome them. In this way these little volumes become at once a great source of indicated desiderata in our data and a no lesser source of stated problems which should be attacked. We may therefore congratulate the authors and ourselves on their accomplishments not alone with respect to the information they have brought together but more especially for the suggestions for further work. Certainly today one of the best methods of studying the social aspects of the depression is to attack some of these their many suggestions.

I do not dare to close without saying that if we are intelligently to discuss depression effects on social institutions we should not overlook the comparative study of a large number of depressions widely separated in space and in time. I very much wish I knew of a good finding list of depressions. True, there cannot be many besides the latest which can be studied satisfactorily on a quantitative statistical basis, but the first step in any comparative study is "systematic," it is to pick out the qualitative characteristics which seem to be of some importance so that we may make a beginning of a hopeful conceptual schematization through the application of such general laws of logic as Stuart Mill's canons of agreement and difference. History is as indispensable a laboratory to the social scientist as is the present-day field.

THE χ^2 -TEST OF SIGNIFICANCE*

BY THORNTON C FRY
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1 THE BASIS OF THE PROBLEM

THE task which has been set me by your program committee is that of explaining the mathematical derivation of Pearson's χ^2 -test, thereby setting the stage for the gentlemen who are to follow me, upon whom devolves the task of making pertinent comments as to the statistical usefulness and limitations of this test. This arrangement obviously relieves me of the necessity of being at all profound or of saying anything new, and I shall make no attempt to do either. Instead, I shall try to present a rather involved mathematical argument as simply as I can and at the same time to bring out the various assumptions which underly it and the numerical approximations with which it is beset.

To begin with, of course, we must know what the problem is which we are trying to solve, which means that we must agree upon the uses to which the test is to be put. Now it happens that the situations to which the χ^2 -test is applied are all of a very simple type. They are cases where two things exist: a set of experimental (I like the word better than statistical) data and a working hypothesis regarding certain probabilities associated with the experiment. From these hypotheses we can compute what we would expect from our experiment on the average. The data will seldom agree exactly with these expectations, however, and hence the question arises in any particular case as to whether the observed discrepancies can reasonably be regarded as chance variations, or whether they are so remarkable as to throw serious doubt on the adequacy of our working hypotheses.

For example, the experiment may have been a simple coin-tossing, and the data may be the number of heads and tails that appear. A working hypothesis may be that the coin is true so that heads and tails are equally likely. The question then is: In the light of the experiment, are we still warranted in retaining this hypothesis, or should we conclude that the coin is almost surely biased?

Or we may have as our data the vital statistics of a large city showing the age at death of a great number of people, and as our working hypothesis a certain mortality curve. The question to be answered is then: Does the assumed curve represent the data fairly, or should we conclude that it is not appropriate to the population of this particular city?

*A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 27, 1937.

Or we may have before us the record of a card calling experiment of the sort which is being carried on by Professor Rhine at Duke University, and as our working hypothesis the assumption that this record is the result of accidental chance guesses only. The question before us is then whether the record is consistent with this hypothesis or whether we are forced to seek another explanation.

Now there are four pertinent comments regarding questions of this sort which I would like to make before even attempting to discuss how they would be answered.

The first is that each such question refers to a *single* set of hypotheses. We are not viewing the data in the light of several possible hypotheses simultaneously and asking whether, in the light of all the information we possess, one is more strongly supported than another. We may, of course, take up a number of such hypotheses in succession and find in the end that our tests of significance mixed with a liberal amount of common sense enable us to rank them relatively to each other. But so far as the purely statistical procedure is concerned, this amounts to solving a number of separate problems each dealing with one, and only one, hypothesis. In this respect we shall find that the χ^2 -test is in sharp contrast with Bayes' Theorem which does view the various possible hypotheses collectively and rates them relatively to one another, but which makes the essential requirement that every possible hypothesis be accounted for.¹

The second remark is a sort of corollary of the first: it is that though a test of significance if it comes out negatively may have the practical result of *discrediting* a particular hypothesis, a positive result would not *prove* it. It would still remain merely an acceptable working hypothesis. This statement is not at variance with the practice so common in the sciences of regarding a working hypothesis which stands up under repeated comparison with fact as proved, for such a position is taken only as a consequence of many tests collectively, and usually because of the failure of rival hypotheses to meet these tests.

In the third place, even with the same data and the same hypotheses to begin with, problems of this sort can frequently be formulated in different guises, in some of which the discrepancies may be rated as significant and in others not. This does not mean, however, that any of the answers is wrong, but merely that in certain cases we have used the available information more effectively than in others. For example, the vital statistics which I mentioned a while ago could be classified in five-year intervals and compared with the expectations as deduced

¹ An elementary discussion of Bayes' Theorem emphasizing these points will be found in *Scripta Mathematica*, II (1934), pp. 205-221, under the title "A Mathematical Theory of Rational Inference."

from the areas under corresponding segments of either of the two curves of Figure 1. They might then show conclusively that the dotted curve was not acceptable, but still leave the other as a satisfactory working hypothesis. If, however, the data were classified into only two groups—those below age 50 and those above—both curves would stand up equally well, since they both predict the same proportion of deaths in these two groups.

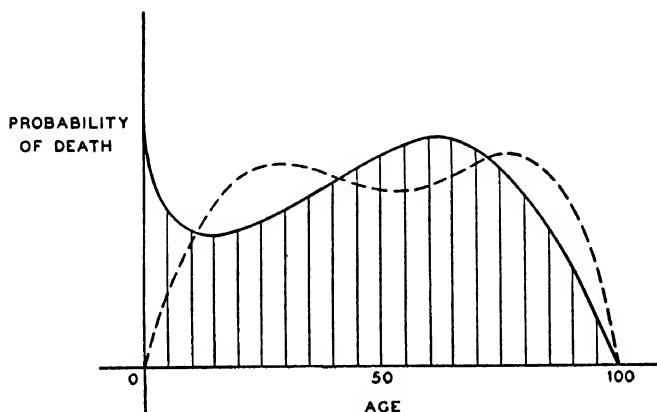


FIGURE 1

In this case a fairly fine-grained classification is desirable in order to extract the maximum possible amount of information from the data. By and large, this is the usual situation. It is therefore an important, though unfortunate, aspect of the χ^2 -test, that it establishes limits beyond which this fine-grained structure must not be carried ²

The fourth and final remark is this: that the very essence of our argument is to inquire to what extent the discrepancies between expectation and observation might reasonably be accounted for by *chance*. If, then, with the data already before us, we deliberately rig up a set of hypotheses so as to disagree violently with the data, we will learn nothing important from applying a test of significance and concluding that the discrepancies could hardly have been due to chance. We already know they were not. Conversely, if we rig the hypotheses into close agreement with certain aspects of the data, we will learn nothing important from observing that the agreement in these respects *might* have happened accidentally; we already know it did not.

Now this observation is very important because it is customary to rig our hypotheses to fit the data in certain respects. We do it whenever

² See in this connection the paper, "The Multinomial Solid and the χ^2 Test," by B. H. Camp, *Transactions of the American Mathematical Society*, 31 (1929), pp. 133-144, and 44 (1938), p. 151.

we determine the arbitrary constants of a distribution function from certain properties of the data. Obviously then, our mathematical treatment must be phrased in a sufficiently general fashion to answer the question whether an experiment which has been forced to agree with the hypotheses in such particulars could be expected by chance alone to exhibit the discrepancies which remain.

We may as well begin our mathematical discussion at this point, which we can do by noting the form which these restrictive conditions usually take in practice. If we denote by p_j the probability associated with the j 'th class (for example, the area of the segment corresponding to the j 'th age group in Figure 1, or the probability associated with heads or tails respectively in the coin-tossing case); by n_j the number of experimental observations falling in this class; and by m the total number of observations made, we have as one relation which is always used

$$\sum n_j = m \sum p_j,$$

or if we prefer to write it so

$$\sum (n_j - mp_j) = 0. \quad (1)$$

We may also use the average of our data to determine a constant in the distribution formula. In this case we require that

$$\sum a_j n_j = m \sum a_j p_j,$$

where a_j is the measure associated with the j 'th group (for example, the *age* in the case of Figure 1). This also may be written in a form similar to (1) as follows

$$\sum a_j (n_j - mp_j) = 0. \quad (2)$$

The use of higher moments, or other statistical devices for estimating parameters, generally leads to equations of the same form as (2), except that the coefficients are different. For example, if we make the standard deviation of the distribution function agree with that of the data, we get an equation just like (2) except that a_j must be replaced by a_j^2 . The factor $(n_j - mp_j)$ remains unaltered, and so does the zero on the right-hand side.

In technical mathematical language this would be expressed by saying that all such equations are *linear and homogeneous in the variables* $n_j - mp_j$.

Phrased mathematically then, our problem is to test the significance of the deviation of certain data from chance expectation when a certain number of such linear homogeneous relations are known to exist.

2. THE ANSWER

So much for the nature of the problem itself. Next we must ask what might be regarded as an acceptable answer. In other words, what is it that constitutes a *significant* disagreement between data and hypothesis? The first and most obvious fact is that the answer is somehow related to the probability of getting the data from an experiment performed under our hypothetical conditions. *Other things being equal*, the smaller this probability is, the more serious the discrepancies are.

But this probability alone is not the whole answer. To see this, let us consider a coin-tossing example, and suppose that in ten throws heads has appeared only once. This certainly cannot be said to be

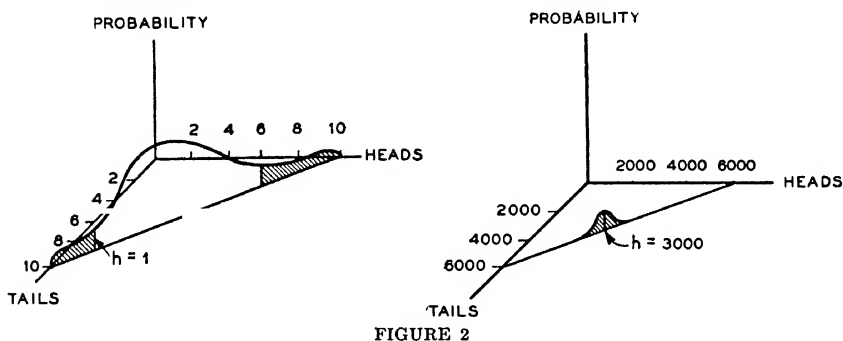


FIGURE 2

very strong support for the hypothesis that the coin is true; not nearly so strong as if heads appeared just 3,000 times in 6,000 throws. Yet the probability of each result is identical, as we see from Figure 2 in which the binomial distributions appropriate to the two cases are drawn to identical scales, and the particular probabilities appropriate to one head out of ten and 3,000 out of 6,000 are shown by the heavy ordinates.³

Figure 2 also gives us a clue to why the exact magnitude of the probability is not of primary importance; for in one case the heavy ordinate is at the exact peak of the curve so that the experimental result, though improbable in an absolute sense, was not at all unusual when compared with the other things that might have occurred. In

³ It would be much more usual to plot the ordinates of Figure 2 against one variable (heads) allowing the other variable (tails) to be understood. I have chosen instead to display them as functions of two variables, between which a certain auxiliary condition exists, so that not all pairs of values are admissible. In this sense both curves are sections cut from a surface whose equation is

$$p = \frac{(h+t)!}{h!t!} \left(\frac{1}{2}\right)^h \left(\frac{1}{2}\right)^t$$

one section being made by the plane $h+t=10$, the other by the plane $h+t=6,000$

At present this form of presentation has no peculiar merit. Later on, however, when we begin dealing with restrictive conditions such as (1) and (2) above, we shall wish to think in these terms, and it will be convenient to have the idea fixed in mind beforehand

the other case the heavy ordinate is well down on the tail of the curve. Relatively to the other things that might have happened, it would rate as decidedly unexpected. Indeed, it is just this matter of how far down on the tail of the curve the experimental results lie, which determines how significant they are.

Pearson's purpose in inventing the χ^2 -test was just exactly to estimate how far below the peak of the curve a given experiment lies. It accomplishes this end by telling what proportion of the area lies still further down, like the shaded part of Figure 2. We see at once that in the case of 6,000 trials the whole area is shaded, and hence the answer is obviously 1. The result of any run of 6,000 tosses would give results at least as unusual as the one under discussion. In the case of ten trials only, about 1/50 of the whole area is shaded, which means that with an unbiased coin only one out of fifty experiments of this sort would give results as unusual (that is, inherently as improbable) as the data before us.

Hence, to test whether an experiment significantly contradicts a hypothesis, we first compute the probability p of obtaining the experimental data from the hypothesis by chance alone, then we imagine a great many more experiments performed under the hypothetical conditions, and find the proportion, P , of them which would be less probable than p . If this proportion P is very small, the experiment contradicts the hypothesis significantly, if not, the hypothesis is still tenable.

3 MATHEMATICAL FORMULATION

We now seek to put these ideas into mathematical form. To this end, we first ask what the probability is of getting n_1 out of m events in class 1, n_2 in class 2, and so on, if the probabilities associated with the various classes are all known. The answer to this question is the familiar one⁴

$$p[n_i] = \frac{m!}{n_1!n_2! \cdots n_s!} p_1^{n_1} p_2^{n_2} \cdots p_s^{n_s}, \quad (3)$$

where s is, of course, the number of classes. This is a perfectly general result, and good for all values of $[n_i]$.

Sooner or later we must talk about the experimental data actually furnished us, and in order to distinguish it from all the other things that *might* have happened and which are covered by the n 's, I shall use Greek characters $\nu_1, \nu_2, \dots, \nu_s$. Then the probability denoted by p in the italicized statement above is

$$p = p[\nu_i] = \frac{m!}{\nu_1!\nu_2! \cdots \nu_s!} p_1^{\nu_1} p_2^{\nu_2} \cdots p_s^{\nu_s}. \quad (4)$$

⁴ In writing square brackets I am using the mathematical abbreviation for (n_1, n_2, \dots, n_s) . In other words, $p[n_i]$ means "the probability of getting n_1 events in the first class, n_2 in the second, etc."

Our next step must be to find what proportion of experiments conducted under the hypothetical conditions would lie at least as far down on the tail of the distribution (3) as does the actual experiment $[v]$. This aspect of the problem is complicated by comparison with that revealed in Figure 2 only because we now have s variables n_i , and hence would require an $s+1$ dimensional space in which to plot the function $p[n_i]$ against them. As we live in 3-space we cannot visualize this plot in detail, but we can infer its principal characteristics from what we already know about Figure 2.

In the first place, not all sets of values $[n_i]$ are admissible because of restrictive conditions such as (1) and (2). Indeed it was exactly the restrictive condition (1) which caused us to confine our attention to the values along a certain straight line in Figure 2 instead of covering the entire plane.

In the second place, we infer from the characteristics of the binomial that $p[n_i]$ will have its maximum values in the neighborhood of the point E whose coordinates are mp_1, mp_2, \dots, mp_s . As we move away from this point in any direction $p[n_i]$ will steadily decrease in value and, if m is finite, will ultimately drop to zero. Hence we can draw a closed surface S_p in the space of s dimensions such that every admissible combination $[n_i]$ for which $p[n_i] > p$ lies *inside* this surface, and all the others lie either on it or outside. Of course, this surface will pass through the point $[v]$ which corresponds to the given data.

We could also draw a great many other surfaces for other values of the probability $p[n_i]$. These would obviously fit together like the layers of an onion, the outside layer corresponding to zero probability and the inner ones to increasingly higher values, with the maximum reached at the common center of all, the point E .

In terms of this picture, the chance that an experiment, conducted under the hypothetical conditions, would fall further down on the tail of the curve than $[v]$ is simply

$$P = \sum p[n_i], \quad (5)$$

the summation being extended over all values of n_i which lie outside the surface S_p , and *on the intersection of the surfaces defined by the equations of condition (1) and (2)*. The latter condition is necessary because, as we explained above, the fact that $[v]$ satisfies these equations is not the result of chance: it was forced to do so. Hence the requirement that $[n_i]$ also satisfy these equations becomes a part of the conditions under which our hypothetical experiments must be performed.

4. THE APPROXIMATE FORMULA

The equation (5) is exact, but in the majority of cases in which we would wish to apply it, it would be so hard to compute as to be practi-

cally useless. To reduce it to a useable form, we must content ourselves with a reasonably valid approximation. To get this, *three separate stages of approximation* will be necessary.

The first stage is to replace all the factorials in (3) by their Stirling approximations. This gives

$$p[n_i] = \frac{1}{(\sqrt{2\pi m})^{s-1} \sqrt{p_1 p_2}} \frac{(mp_1)^{n_1+\frac{1}{2}}}{p_1} \left(\frac{mp_2}{n_2}\right)^{n_2+\frac{1}{2}} \left(\frac{mp_s}{n_s}\right)^{n_s+\frac{1}{2}}. \quad (6)$$

The next step in the process—this one does not involve an approximation—is to introduce a new set of variables of such a character as to make the surface S_p as nearly spherical as possible, and at the same time transfer its center to the origin of the coordinates. This change has two advantages: it will ultimately be found to have made all the other layers of our onion spherical also, so that $p[n_i]$ will depend only on their radius variable r , instead of upon the set of s variables $[n_i]$; in the meantime it will be a great help in selecting the quantities which we may legitimately discard as unimportant. Selecting such quantities is not easy when the important range of values for one of the variables differs much from one of the others. But since the points in any one layer of the onion are of equal importance, the important range of values will obviously be the same for all variables once the onion is made round. It turns out on trial that these objectives are attained by means of the substitution

$$n_i = mp_i + x_i \sqrt{mp_i}; \quad (7)$$

and when we make this in a typical factor of (6), we get

$$\left(\frac{mp_i}{n_i}\right)^{n_i+\frac{1}{2}} = \left(1 + \frac{x_i}{\sqrt{mp_i}}\right)^{-mp_i - x_i \sqrt{mp_i} - \frac{1}{2}}. \quad (8)$$

We are now ready for our second stage of approximation. It is similar in character to the familiar one by which an expression of the form

$$\left(1 + \frac{x}{m}\right)^m$$

is replaced by e^x when m is large. In the present case, the result turns out to be

$$\left(\frac{mp_i}{n_i}\right)^{n_i+\frac{1}{2}} \doteq e^{-x_i \sqrt{mp_i} - \frac{1}{2} x_i^2}. \quad (9)$$

When we multiply together the s factors of this sort which appear in (6), the result becomes even simpler; for we see at once from (7) that

$$\sum \sqrt{mp_i} x_i = \sum (n_i - mp_i);$$

and the universal condition (1) tells us at once that this is zero at all admissible points. Hence (6) becomes

$$p[n_i] = \frac{1}{(\sqrt{2\pi m})^{s-1} \sqrt{p_1 p_2 \cdots p_s}} e^{-\frac{1}{2}(x_1^2 + x_2^2 + \cdots + x_s^2)}. \quad (10)$$

We may now note that the change of variable (7) has indeed made all the sections of our onion spherical, since $p[n_i]$ has the same value at all points of the hypersphere

$$x_1^2 + x_2^2 + \cdots + x_s^2 = r^2. \quad (11)$$

Our third approximation has to do with the summation by which P is obtained in (5), and amounts merely to replacing this discrete sum by an integral over the region in which the admissible points lie, that is, the region outside the surface S_p . But this surface, like all the other layers of our onion, is now spherical, and hence characterized by the value of its radius alone. If we denote by

$$\xi_i = (v_i - mp_i)/\sqrt{mp_i},$$

the particular values of the x 's which correspond to our experimental data, and write (as is usually done)

$$\chi^2 = \xi_1^2 + \xi_2^2 + \cdots + \xi_s^2, \quad (12)$$

we see at once that the radius of S_p must be χ , for we have already noted that the point $[v_i]$ lies on this surface.

Hence the integral which we must compute takes the very simple form

$$= K \int_{r=\chi}^{\infty} e^{-\frac{1}{2}r^2} dV. \quad (13)$$

I have here written a constant K to take care not only of the constant multiplier in (10) but also of any factor that may be introduced in changing from an element of volume in the variables $[n_i]$ to an element of volume in $[x_i]$. As the variables are not all independent, it would be a bit troublesome to compute this factor at this time, but we know it must be a constant since the equations connecting x_i and n_i are all linear.

We are now done with our approximations, but we must still express our element of volume dV in an explicit form before (13) can be computed. To do this, we must examine our "admissible region" a bit more closely. We have already said that it is composed of those points in the space of the s variables $[x_i]$ which lie on the intersection of the surfaces corresponding to the equations of condition. The latter, however, are known to be linear and homogeneous in the variables $n_i - mp_i$; and from (7) we see that this means they are linear and homogeneous in x_i . Now *linear* equations represent hyperplanes, and when they are *homogeneous* the planes pass through the origin; and because of these two peculiarities the admissible region turns out to be a very simple one, as we can readily see by analogy with the more familiar three-dimensional case.

If we consider the three variables x_1, x_2, x_3 the surface S_p becomes an ordinary sphere of radius χ with its center at the origin. A single plane through the origin cuts this in a circle, also of radius χ , and if this plane represented the only equation of condition the admissible region for the x 's would be the portion of this plane for which $r \geq \chi$. Two conditions on the other hand would correspond to a pair of planes through the origin. They would both be fulfilled by the points of the line at which these planes intersect. This line also passes through the origin and hence the admissible region is that part of the line along which $r \geq \chi$.

In other words, one condition has reduced us from three dimensions to two, two conditions from three dimensions to one; and we naturally infer (and quite correctly) that in the most general case q conditions would reduce us from a space of s dimensions to one of $s' = s - q$ dimensions. Hence, in (13) dV is a volume element in space of s' dimensions. We also infer (and again quite correctly) that in this reduced space of s' dimensions we are to integrate over all values of r which exceed χ .

Next we seek a more explicit expression for the volume element dV . Since the integrand depends only on r , it is appropriate to take for dV the volume between two hyperspheres of radius r and $r + dr$. We are quite accustomed to doing this in two or three dimensions, and again we can get a clue to the size of this volume element from the consideration of these familiar spaces of low degree. When we integrate a function of r in 3-space we know that the element of volume is $\pi r^2 dr$ (that is, the area of a sphere of radius r multiplied by the distance dr); in 2-space it is $2\pi r dr$ (that is, the circumference of a circle of radius r multiplied by the differential distance dr) while on a line it is simply $2dr$. In other words, in a space of s' dimensions we would expect it to be (and again correctly so) $r^{s'-1}$ multiplied by some constant, the

exact value of which we may allow to be absorbed by that very useful arbitrary constant K . We thus obtain

$$P = K \int_x^\infty r^{s'-1} e^{-\frac{1}{2}r^2} dr. \quad (14)$$

Only K is now undefined, and it is easily determined. For obviously the proportion of experiments in which $x_1^2 + x_2^2 + \dots + x_s^2 \geq 0$ must be 1; hence

$$\frac{1}{K} = \int_0^\infty r^{s'-1} e^{-\frac{1}{2}r^2} dr,$$

which is known to be

$$\frac{1}{K} = 2^{\frac{1}{2}s'-1} (\frac{1}{2}s' - 1)!$$

I shall not bore you by explaining how one goes about reducing the integral (14) to numerical form. The processes are tedious and without either mathematical or statistical interest. It is only important to know that they lead at the end to double-entry tables with s' and χ^2 as parameters. You are all no doubt familiar with these, but some of you at least may not have realized that they represent a working approximation to the more exact formula (5), which in spite of its apparent simplicity is actually too complicated for practical use.

5 RÉSUMÉ

In concluding my talk, it may be wise to review hastily the major ideas, which have perhaps been somewhat obscured by the necessity from time to time of dwelling on details.

First: The problem which we are seeking to solve is that of determining whether certain data could reasonably be expected to be the chance result of certain hypotheses; in other words, whether the data do or do not contradict the hypotheses to a significant degree.

I must again stress the fact that it is *disagreement* between data and hypotheses which is important. That gives reason for thinking the hypotheses are wrong. *Agreement*, on the other hand does not mean that the hypotheses are right, for there are usually many other sets of hypotheses that would agree equally well. It is only when agreement is so good that we would hardly expect it to come by chance—say when P is 0.99 or greater—that it can be said to carry implications, and then only because such figures frequently result from a misuse of the theory.

For example, if so many arbitrary constants in a distribution have been determined from the data as to leave almost no independent degrees of freedom—that is, if s and q are both large, but $s' = s - q$ is small—and if we enter the tables with s instead of s' , we will almost certainly get such a result. Or if we compare the entries in a table of logarithms with the function $\log x$ the χ^2 -test will give us $P=1$, since in this case there is obviously no disagreement. But equally obviously we have no right to make the test, for the binomial law (3) is the law of *repeated independent trials*, and hence we are only warranted in applying the χ^2 -tables to data that are known to result from trials of this kind.

Both of the preceding examples involve misuse of the χ^2 -test. We add still a third example where the test itself is correctly used, though, as it happens, in this case the tables are not needed and could not be applied. Suppose the 52 cards of a deck are dealt and their order noted. We ask whether the result deviates significantly from chance; that is, whether there is evidence of control. Now, as all orders are equally likely, the proportion of chance orders which are as improbable as the one observed is 1; and this is so no matter whether the cards fell in a very inconspicuous order or whether they fell in the rather conspicuous one in which they came from the maker.⁵ Here the answer $P=1$ conveys no important information—so far as purely statistical ideas are concerned no order could possibly be significant.

When P is very large, then we may wisely reexamine our procedure to see if it is in error. But if we find that it is not, the high value of P is of no particular significance.

Second: The criterion by means of which significance is tested is the proportion of chance experiments which would disagree with the hypotheses to at least as remarkable a degree as the one under test. I

⁵ It may be well to point out that in tests of a posteriori probability such as Bayes' Theorem, the logical situation at this point would be very different. We expect a stacked deck to possess conspicuous peculiarities of order, and hence we would find under the circumstances mentioned in the text that Bayes' Theorem would lead to a presumption that the deck was stacked, or at least to a stronger probability in that direction than existed before the experiment was performed. Exactly which of these situations occurred would depend on the a priori probabilities that enter the computation.

I mention Bayes' Theorem in this connection because it emphasizes the necessity for a common sense interpretation of statistical tests which ignore the frequently intangible prior probabilities. The χ^2 -test of significance belongs to this class, and I rather deprecate the tendency to adopt an iron-clad rule as to the value of P which represents the border line of significance. For ordinary situations the commonly adopted $P=0.01$ is probably reasonable enough, but in work like Rhine's where a strong prejudice (I use the word here in its etymological sense) exists against the occurrence of ESP, much smaller values of P and a much more impressive array of data generally may properly be demanded.

It is only fair to add that I believe Professor Rhine also holds to this opinion. At all events, he has extended his studies far enough to obtain values of P (some of them smaller than 10^{-20}) which would appear to be conclusive enough to silence the most ardent exponent of the thesis that his results have been obtained by chance. Whether the explanation which Rhine advances is the correct one or whether a better one exists cannot, of course, be determined by significance tests alone for as we have already strongly emphasized, the function of such tests is to disprove hypotheses, never to prove them.

have already framed this idea in several different forms: let me add another which, though redundant, is nevertheless illuminating. *The Pearson criterion of significance is the proportion of chance experiments which would contradict the hypotheses at least as significantly as the data do.*

In this connection, I wish only to emphasize once more that the criterion of itself goes no further than this: in particular it says nothing about the relative merits of several hypotheses. I may illustrate this by the playing card example already referred to. We may assume that the observed order was that of a new pack and test two sets of hypotheses: first that the result is accidental, second that an attempt was made to order the cards in just this way. We have already seen that $P=1$ on the basis of the chance hypothesis. It cannot possibly be higher for the other, but this certainly does not mean that the other hypothesis is not the more tenable one; for due to psychological factors we would expect a manipulator to be attracted by this order, so that the prior probability of manipulation is high, and the Pearson test pays no attention to prior probability.

SOME DIFFICULTIES OF INTERPRETATION ENCOUNTERED IN THE APPLICATION OF THE CHI-SQUARE TEST*

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THE remarks that I have to make are not derived from any considerations of the mathematics of the chi-square test.¹ I have a considerable interest in mathematical statistics, but very little competency in it. You will not hear anything about cards or black and white balls from me. I shall speak as a practitioner who has frequently applied the test to real observations, made seriously for the solution of concrete scientific problems. I have used the chi-square test to help make decisions as to the character of experimental data in situations in which I had every reason to think it was appropriate. I have used it in the same spirit in which we doctors use, say, the Wassermann test, to help make decisions in situations where we think a patient may have syphilis. In the course of these experiences I have encountered numerous situations in which the test did not adequately perform the function for which I thought I could use it, and I shall present a few examples *seriatim*.

I. I believe that an observant statistician who has had any considerable experience with applying the chi-square test repeatedly will agree with my statement that, as a matter of observation, when the numbers in the data are quite large, the P 's tend to come out small. Having observed this, and on reflection, I make the following dogmatic statement, referring for illustration to the normal curve: "If the normal curve is fitted to a body of data representing any real observations whatever of quantities in the physical world, then if the number of observations is extremely large—for instance, on the order of 200,000—the chi-square P will be small beyond any usual limit of significance."

This dogmatic statement is made on the basis of an extrapolation of the observation referred to and can also be defended as a prediction from *a priori* considerations. For we may assume that it is practically certain that any series of real observations does not actually follow a normal curve *with absolute exactitude* in all respects, and no matter how

* A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 27, 1937

¹ In this discussion I mean, by the chi-square test, the comparison of two sets of frequencies in which chi-square is the sum of the terms $(o-t)^2/t$ calculated from the observed and theoretical frequencies, not other tests using the chi-square distribution, such as the testing of the significance of the difference of an observed and theoretical variance.

small the discrepancy between the normal curve and the true curve of observations, the chi-square P will be small if the sample has a sufficiently large number of observations in it.

If this be so, then we have something here that is apt to trouble the conscience of a reflective statistician using the chi-square test. For I suppose it would be agreed by statisticians that a large sample is always better than a small sample. If, then, we know in advance the P that will result from an application of a chi-square test to a large sample, there would seem to be no use in doing it on a smaller one. But since the result of the former test is known, it is no test at all!²

II. In Table 1 and Chart I are shown four series of observations of basal metabolism for humans, each representing a different situation. To each series a normal curve has been fitted and a chi-square test for goodness of fit made. Judging the results in the routine way, and using $P=0.05$ as the limit of significance, we would say that the first fit ($P=0.62$) is good, *i.e.*, not rejected; the second and third ($P=0.02$) would be rejected; about the fourth ($P=0.996$), there is a question as to what should be done. Fisher says: (*Statistical Methods*, 4th ed., p. 83) "Values over 0.999 have sometimes been reported which, if the hypothesis were true, would only occur once in a thousand trials. . . . In these cases the hypothesis considered is as definitely disproved as if P had been 0.001." I can only interpret this to mean, applied here, that the hypothesis that the distribution comes from a normal universe is to be rejected just as definitely as it would have been if the P had been 0.004.

Now, in these four instances, when I considered them from my own personal viewpoint, I actually made the following decisions: The first I considered a good fit, *i.e.*, I accepted the conclusion that on the evidence at hand these observations follow the normal curve. (I will not stop for the hair-splitting question as to whether I accept or merely do not reject. This question is operationally meaningless, for I had to tell my readers whether I thought the distribution was sensibly normal or not, on the evidence at hand. Of course I knew I might be wrong, just as I would if I made a positive diagnosis of syphilis by the Wassermann test.) In the second case I rejected the hypothesis that these observations follow the normal curve. In these first two cases,

² Lest this be interpreted as a comment upon all tests of significance, I should like to note, without attempting here to adequately amplify the point, that there is an important distinction between the physical connotation of a test for, say, the significance of a difference between means or variances and a chi-square difference. We conceive a *true* difference of means, or a *true* difference of variances, which corresponds to the *true* distributions. These can be operationally defined. The tests are, so to speak, comments upon our estimates of these *true* differences. But there is nothing that corresponds to a *true* chi-square difference between the *true* distributions. The chi-square corresponds to no definable specific character of the *true* distribution. It is not a descriptive parameter like the standard deviation.

then, I agreed with the routine conclusion. In the third case I did *not* reject the hypothesis that the observations follow the normal curve, and in the fourth, I accepted the hypothesis of normality with confidence. In the last two cases, therefore, there is a difference between the decision made on the routine test and what I actually did in practice.

TABLE 1
BASAL METABOLISM OBSERVATIONS

Deviation from mean in class units* (mid-value)	Series 1			Series 2			Series 3			Series 4		
	Obs	Th	O-T	Obs	Th	O-T	Obs	Th	O-T	Obs	Th	O-T
below -4	1}			2}			1}			10	9 0	+1 0
-3 5	3}	25 3	+1 7	11}	21 1	-8 1	1}	14 8	-1 8	12	10 7	+1 3
-2 5	23}						11}			17	18 4	-1 4
-1 5	53	45 3	+7 7	48	32 9	+15 1	47	39 8	+7 2	27	26 0	+1 0
-0 5	68	69 9	-1 9	53	49 5	+3 5	67	72 4	-5 4	31	30 9	+0 1
+0 5	71	69 9	+1 1	49	49 5	-0 5	80	72 4	+7 6	30	30 9	-0 9
+1 5	36	45 3	-9 3	26	32 9	-6 9	26	39 8	-13 8	26	26 0	0
+2 5	19	19 1	-0 1	12	15 3	-3 3	17}	14 8	+6 2	17	18 4	-1 4
+3 5	5}			1}	5 8	+0 2	4}			10	10 7	-0 7
over +4	2}	6 2	+0 8	5}						10	9 0	+1 0
Total	281	281		207	207		254	254		190	190	
Median†	-0 11	0		-0 17	0		0	0		-0 07	0	
S D †	1 49			1 57			1 27			2 39		
Skewness	+0 08±0 05			+0 32±0 06			0			+0 09±0 06		
χ^2	3 5			12 4			10 1			0 7		
D F	5‡			4			3			7		
P	0 62			0 02			0 02			0 996		

* For experiment 1 the class unit includes 2 calories per square meter per hour, for experiments 2, 3, and 4 it includes 1 calorie per square meter per hour

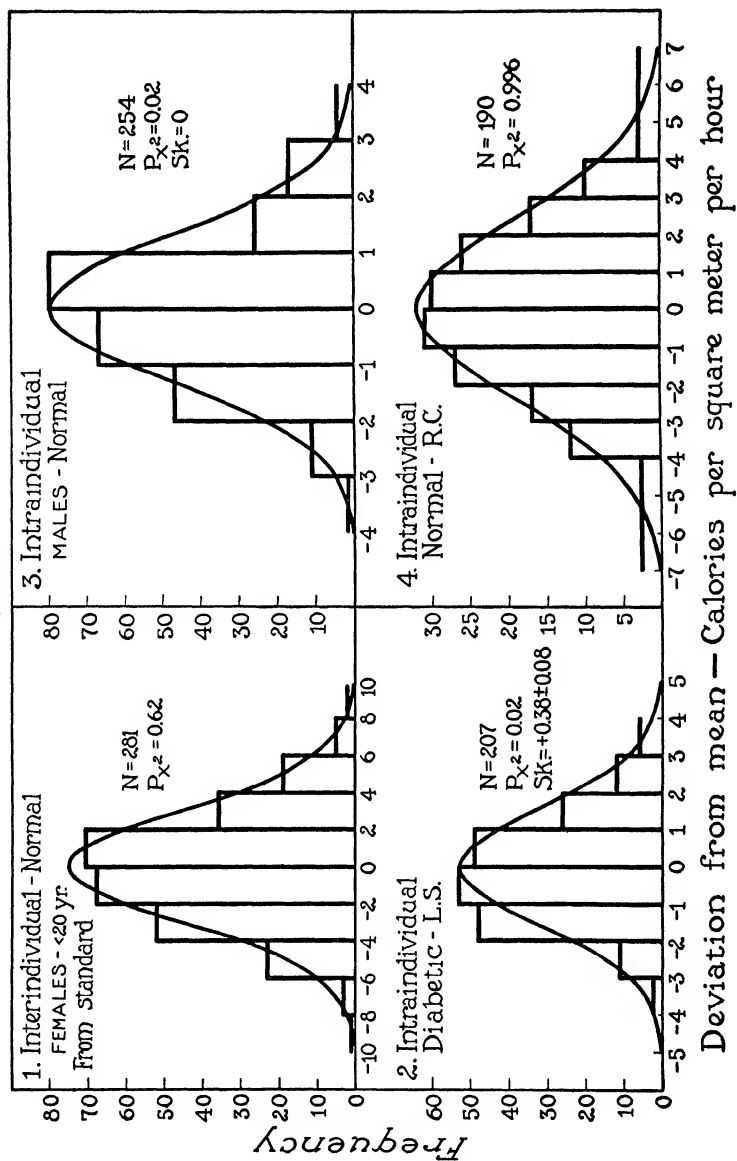
† Calculated from original data measured to 0.1 calorie, ungrouped.

‡ Deviations in this experiment are measured not from the observed but from a standard mean, and the normal curve fitted around the theoretical mean of zero, using the observed total frequency and S D. Hence the D F. equals classes minus 2

If I differ with the conclusion of the test, I may inquire on what basis I made my decision and what explains my difference. For this purpose I can outline my own view as to what is the valid logical basis of the decision in any case, even the routine one. My statement of the reasoning involved will differ in certain respects, I believe, from that which would be given, say, by Fisher. Take the first two cases, in which the decisions agree. I believe the viewpoint as represented by Fisher, say, would, briefly, be something as follows:

I set up for the first case the null hypothesis that there is no difference between this distribution and a normal one. I make a test to see

CHART I



how frequently such an experience as I have at hand would appear on this null hypothesis and, using the chi-square test for this purpose, I arrive at the conclusion that an experience with as large a chi-square difference would occur six times out of ten. There is, using the arbitrary limit of $P=0.05$, no disproof of the null hypothesis. In the second case we go through the same reasoning and reach the conclusion that, on the null hypothesis that there is no difference, so large a chi-square would occur only two times in a hundred, and the null hypothesis is therefore rejected on account of the rarity of such an experience on this hypothesis.

I believe this reasoning is fallacious and that, logically, there is no ground for rejection, whatever the size of the P , if the consideration is limited to that P alone. However, since I came to the same conclusion and did, for instance, reject, in the second case, what do I think is the valid reasoning?

I would say: I have a set of observations at hand which I think may be normally distributed. (I think so because I have seen observations of a similar character that I was satisfied followed sensibly the normal curve.) I also think they may not follow the normal curve but some regular non-normal curve. (I think this may be because I have seen bodies of data like this which do not follow the normal curve but which were, for instance, skew, etc.)³ I then make an inquiry along the following lines: If the observations come from a normal distribution, how frequently would such a chi-square as I got occur? The conclusion is, "Quite rarely—only two times in a hundred." I then make an inquiry, not stated and not calculated, but I believe absolutely necessary for the completion of a valid argument, as follows: If the distribution is non-normal, this experience, judged by a chi-square difference, would occur quite frequently. (All I have to do is imagine that the non-normal curve has the observed skew character of the distribution.) I therefore reject the normal hypothesis on the principle that I accept that one of alternative considered hypotheses on which the experienced event would be more frequent. I say the rejection of the null hypothesis is valid only on the willingness to accept an alternative (this alternative not necessarily defined precisely in all respects).

Now the line of reasoning that I have described, as contrasted with what I have described as the more usual, would explain why my decision differs from the routine one in the third and fourth cases.

³ The importance of the consideration of a set of alternative hypotheses in statistical reasoning has been set forth very entertainingly by Fry, 1933 ("A Mathematical Theory of Rational Inference," published in *Scripta Mathematica*, II (1934), 204-221.) The argument developed here under II may be considered an application of the general viewpoint advanced by Fry to the specific question of the interpretation of the chi-square test.

With regard to the third case, after I have tried the chi-square test, I have reached the conclusion, that on the hypothesis of no difference from normality, a distribution with so large a chi-square would occur rarely. So far we are in exactly the same position as we were at this point in the second case. But now let me examine the probability that this experience would occur if the original supply were a regular non-normal one. Would this experience occur more frequently? There is no reason to say so. The distribution is perfectly symmetrical, i.e., the skewness is zero (there were exactly 50 per cent of the cases on each side of the mean), and a cursory examination of the differences from expected frequencies in the different classes shows they are not systematic, i.e., the plus deviations and minus deviations alternate in random order. Such a distribution is not to be expected frequently from any plausible non-normal curve. We therefore have *no reason at hand for rejection of the normal curve*.

My view is that *there is never any valid reason for rejection of the null hypothesis except on the willingness to embrace an alternative one*⁴ No matter how rare an experience is under a null hypothesis, this does not warrant logically, and in practice we do not allow it, to reject the null hypothesis if, for any reasons, no alternative hypothesis is credible. The fact that statisticians talk in terms of the null hypothesis and disproving it, is due to the circumstance that the numerical calculations can usually be made only with this part of the problem. The fact that the alternative hypotheses cannot be dealt with *numerically* should not lead to the fallacious conclusion that they do not form an integral part of the necessary logical structure by which the null hypothesis is rejected.

It is easy to see by the reasoning that I have given why, in my view, there is absolutely no reason for rejecting the normal fit for the fourth case. The event at hand has been proved, by the finding of a $P = 0.996$, to be of a very rare kind under the normal hypothesis, surely, and on the basis of the principle that such a rare event is itself a warrant for rejection, we should reject it here, and Fisher seems to say we should.

⁴ It is not necessary, for the purposes at hand, to define the alternatives at the outset. Indeed it may be economical not to do so. As the argument is advanced here, rejection of the null hypothesis depends on the acceptance of an alternative according to which the observed event would be impressively more frequent. It is understood, of course, that the alternative need not be defined completely or precisely. We will be interested, therefore, in the end, only in such other hypotheses as agree with the observations, and we may wisely wait till the analysis is made to select for consideration only such other hypotheses as are agreeable. The procedures may therefore be outlined in logical order as follows: (1) The chi-square P is evaluated, if it is not unusually low, the null hypothesis may be accepted so far as the evidence in hand is concerned. (2) If the P is unusually low, other hypotheses, agreeing with the data (i.e., which would yield a P like the one found) are to be considered. For any such a one we will then wish to know: (a) is it alternative, i.e., different from the null hypothesis in a respect pertinent to the problem in hand?; (b) does it have *a priori* plausibility? If both these conditions are fulfilled, the null hypothesis is rejected in favor of the alternative.

But in my formulation we must now ask whether the experience would be comparatively *frequent* under a non-normal distribution. Of course, the experience would be comparatively *infrequent*. If the fit seems miraculous on the hypothesis of normality, it would be even more so on a hypothesis of non-normality. Were an alternative hypothesis, to the effect that the data had been falsified to render them normal, pertinent and tenable in the circumstances, there would be ground for rejection. But even then what would be rejected is not the hypothesis but the data.

TABLE 2

DATA FROM A STUDY TO DETERMINE THE EFFECTIVENESS OF A CERTAIN VACCINE IN THE PREVENTION OF THE COMMON COLD

	Total Group			Males			Females		
	Num- ber	Affected		Num- ber	Affected		Num- ber	Affected	
		No	Per cent		No	Per cent		No	Per cent
Experimental	143	121	84.6	70	57	81.4	73	64	87.7
Control	157	145	92.4	80	72	90.0	77	73	94.8
Total	300	266	88.7	150	129	86.0	150	137	91.3
Difference, Control-Experimental			+7.8			+8.6			+7.1
P, χ^2 for 1 D F		0.02			0.07			0.06	
P , Normal distribution Difference/S.E. difference		0.02			0.07			0.06	
P , Normal distribution Mean difference/S.E. mean dif- ference					0.02				
P , Sum of χ^2 for 2 D F					0.05				

III. In Table 2 are given the results from an experiment that was performed to determine the effectiveness of a certain vaccine in the prevention of the common cold. If we consider the total group, we see that the experimental group had 7.8 per cent fewer affected than did the control group. If this difference is examined by the chi-square test, we get a P of 0.02, which is significant, we will say. (Half the P of the chi-square tables is used since only positive differences are relevant here.) The same question can, of course, be answered by examining this difference with its S.E., the latter evaluated as $\sqrt{PQ(1/n_e + 1/n_c)}$ where P is the rate for the total group; these two answers are identical, as we know, for the four-fold table. Now let us look at the subdivision of the data into males and females. Using the same procedures in each

four-fold table, we get for the males a $P=0.07$, not significant, and for the females $P=0.06$, not significant. We may combine the results for the two sexes by using the mean of the two differences. Examining this in the light of its S.E., we again get a $P=0.02$, the same value as before for the combined group. Looked at this way, we substantiate the previous conclusion that the significance of the difference for the experience taken as a whole is measured by a P of 0.02. Now suppose we combine the experience of the males and females by using the theorem that for independent tables we may use the sum of the chi-squares with the sum of the degrees of freedom to obtain a P . We get $P=0.05$, a value that may appear reasonable considering the P 's for the males and females separately. But the P obtained this way, 0.05, is not significant, while the value previously obtained, 0.02, is. In the problem here cited there are methods available for combining the males and females to perform a chi-square test other than that of summing the chi-squares and the degrees of freedom, and I am only citing this example to demonstrate that the P obtained in the latter way may not be a good basis for judgment. I think that where the chi-square test, using the sum of the chi-squares and the degrees of freedom, fails in this example is in not being sensitive to the similar directional character of the difference. Since the chi-square function squares the differences from expectation, it destroys the value, if there be one, of knowing the sign. One can, of course, make additional different tests depending on the expectation of the distribution of signs. But my point here is that the chi-square test routinely used is not doing this and, except where you haul out an example, as I have done, you would not know it because the general direction of the results when the P is obtained by summing of the chi-squares and the degrees of freedom is reasonable. The matter becomes of practical importance when the separate tables cannot be validly combined into a single table, and this as well as another point I shall attempt to illustrate next.

IV. In Table 3 is a resume of five series of observations on the number of blood cells counted in a hemocytometer chamber. The cells in each of 400 squares of the entire hemocytometer chamber were enumerated. Since it had been demonstrated previously by "Student" (*Biometrika*, 5 (1906-1907), 351-360) that this distribution is theoretically Poisson, and this being an important matter for me to know about, I, like "Student" with his series, compared the Poisson distribution by the chi-square test for each of the five experiments. The test was made for each series in the usual way. That is, each observed mean determined a Poisson, which was used to calculate the theoretical frequency for each number of cells. The chi-square test was performed,

TABLE 3
CHI-SQUARE TEST FOR "GOODNESS OF FIT," POISSON DISTRIBUTION

Erythro- cytes	Experiment									
	I		II		III		IV		V	
	Th	Ob	Th	Ob	Th	Ob	Th	Ob	Th	Ob
0	↑ 6 92	0	↑ 17 31	0	↑ 6 77	0	↑ 14 33	1	↑ 12 45	2
1	↓ 17 81	5	↓ 27 64	2	↓ 35 17	6	↓ 24 05	1	↓ 27 83	10
2	17 81	19	11	11	17 50	17	10	10	27 83	21
3	35 63	33	20	20	35 17	38	21	21	49 28	52
4	53 48	49	44 86	49	53 01	52	40 56	32	65 44	63
5	64 21	59	58 25	54	63 91	65	54 72	55	69 53	77
6	64 25	78	63 03	75	64 23	69	61 53	79	61 55	62
7	55 10	57	58 46	70	55 33	46	59 32	64	46 72	46
8	41 35	38	47 44	42	41 70	40	50 03	45	31 03	41
9	27 58	29	34 22	34	27 95	28	37 51	35	18 32	11
10	16 56	19	22 22	24	16 86	22	25 31	28	9 73	8
11	9 04	9	13 12	9	9 24	10	15 53	16	↑	5
12	↑	5	↑	7	↑	5	↑	10	↑	2
13	↑	0	↑	1	↑	1	↑	3	8 12	0
14	8 07	0	13 45	1	8 33	1	17 11	0	↓	0
15	↓	0	↓	1	↓	0	↓	0	↓	0
<i>m</i>	6 04		6 49		6 03		6 75		5 31	
χ^2	6 48		11 35		4 20		10 01		9 33	
D F	10		9		10		9		9	
<i>P</i>	0 77		0 25		0 94		0 35		0 41	
<i>s</i>	2 46	2 33	2 55	2 33	2 46	2 45	2 60	2 39	2 30	2 18
ns^2/m	357 53		332 51		396 29		338 30		357 80	
<i>P*</i>	0 14		0 01		0 94		0 03		0 14	

Total $\chi^2 = 41.37$, $P = 0.71$ for 47 degrees of freedom

Total $ns^2/m = 1782.43$, $P = 0.0006$

* The *P* here is the probability of getting in random samples from a Poisson distribution so large a discrepancy between s^2 and m as that observed. The appropriate *P* is therefore the one corresponding to a difference from the mean chi-square as large in either direction as that observed, i.e., the *P* for a discrepancy in one direction is doubled. The observed chi-square is given by ns^2/m where n is the number of degrees of freedom, which for each experiment is 399, and for the total chi-square is 1995.

comparing theoretical and observed frequencies and using as degrees of freedom 2 less than the number of classes, since the theoretical distribution and the observed data agree with respect to the mean and total number. Table 3 gives the results. It is seen that in no single instance would the Poisson be rejected by the routine chi-square test, and considering the entire series together, by adding the chi-squares and the degrees of freedom we get a *P* of 0.71, no value for rejection. I, then, as a practitioner would say, as "Student" did say with a similar experience, that the cells followed the Poisson distribution. Having, therefore, decided to accept on the basis of the chi-square test that the Poisson distribution applies, I now go forward with my

experiment on the assumption that I can say that the standard deviation is equal to the square root of the mean, which is true for the Poisson distribution. In fact, it was in order to be able to calculate the variability from the mean that I made the test of the Poisson in the first place. It was natural for me, then, to set down for each experiment a comparison of the variance and the mean. When this was done, it was found that for each experiment the observed value of the variance was *less* than the expected value for the Poisson! A glance at the table should convince one that the S D. is really less than \sqrt{m} , for in each experiment it is less, and it is very improbable that five random discrepancies would be simultaneously in the same direction by chance. But if one wishes to make statistical tests for this, they can be made in a number of ways. One can test the ratio between the mean of the differences and its standard error in the classic way, or by the *t*-test, and the mean difference is found to be exceedingly significant. Whatever way the test is made, in fact, the difference from the hypothesis that the variance is equal to the mean is in the order of 4 sigmas. Interestingly enough, one of the ways of testing whether the variance is equal to the mean is to use the chi-square function (not the chi-square test as it has been discussed up to now). For the Poisson distribution ns^2/m is equal to chi-square for *n* degrees of freedom, where *n* is the number of degrees of freedom used in calculating *s*. Table 3 shows the *P* value obtained by using this test for each of the experiments; and for all the experiments taken together it is 0.0006. We have now the surprising result that, considering the experiment as a whole, the chi-square test for goodness of fit of the Poisson shows no reason for rejection, whereas any test for the principal characteristic of the Poisson—namely, that the standard deviation is equal to the square root of the mean—shows indubitably that this is not true.⁵

I should attribute this discrepancy in conclusions, according as to whether they are drawn from the application of the chi-square test for goodness of fit or from a direct test for the agreement of the variance and mean, to two defects of the chi-square test considered as a test to be applied to a situation such as described here. The first is the nonspecific character of the chi-square test. The test is frequently referred to as a test for the "goodness of fit," but it is such a test only in the tautologic sense that it tests whether chi-square fits. A test can be applied only as respects a certain measurement. We recognize regularly that finding a significant difference between the mean of an

⁵ "Student's" observations using yeast cells do not agree with mine in regard to the relation of the standard deviation to the mean, and, therefore, with "Student's" observations I should have drawn the same conclusions that he did. What I mean is that he did not find it necessary to supplement the chi-square test

experiment and a hypothetical curve does not warrant rejection of the curve in other respects, say, the standard deviation. These two statistics are functions, and it is because these functions are related to certain specific physical characteristics that a significant difference in respect of them has great meaning. So, too, a significant difference tested by another function reflects a significant difference in kurtosis or skewness, etc. Every function is only a variable mathematically, and an independent investigation is required to reveal what this variable represents physically. If I say that a significant difference found by testing the probability of an experienced value of a certain variable divulges a difference only as respects the character represented by that variable, I may ask, "*What characteristic does the chi-square variable represent?*" I don't think there *is* any specific characteristic, and I believe that is one of the chief deficiencies of the chi-square test so far as its value for practice is concerned.

The second defect has to do with why, though we may be sure there is a small regular difference between the distribution of cells in the hemocytometer chamber and the Poisson, even the combined experience embracing a frequency of 2,000 hemocytometer divisions and about 13,000 erythrocytes did not divulge this as a significant difference when the various experiences were combined by summing the chi-squares and the degrees of freedom. This, I think, is another exemplification of the point I was trying to make under III. The differences were all in one direction, but the chi-square test for different independent samples combined, effected by adding the chi-squares and the degrees of freedom, was insensitive to this fact.

There is no room here for further elaboration of these views, or even for an adequate summary of the points already made. I may, however, record my impression that in practice the chi-square test is being relied on too much and too uncritically. As an exploratory tool for preliminary survey it may have some usefulness. But for any more searching analysis—as, for instance, if one wishes to base some theoretical development on the frequency function—one should seek first to ascertain functions that refer specifically to the questions at hand, and apply statistical tests that are sensitive to variations in those specific functions.

FURTHER INTERPRETATIONS OF THE CHI-SQUARE TEST

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DR. BERKSON's very interesting paper¹ raises so many questions concerning the validity and limitations of the chi-square test that it seems desirable that at least brief replies should be made to some of them. As a basis for discussion, let us first assume the following *Postulate: An hypothesis is to be rejected if the total probability of all samples as "bad" as (or worse than) the sample observed is less than some small number (say .01) previously agreed on.* This postulate is implicit in many tests of significance, various meanings being attached to the word "bad." In the chi-square test a sample is supposed to be as bad as another if it has as small a probability as the other. Moreover, both the sample and the universe are specified by their relative frequencies in a finite set of categories or "cells." This postulate is in accord with Fry's introductory remarks.² No attempt will be made to prove it, nor would the author be disposed to quarrel with anyone who would not accept it; for the time being at least he is only interested in the logical conclusions which flow from it.

As a first corollary of this postulate we must note that it supports Berkson in contradicting the statement of R. A. Fisher, with regard to high values of P , quoted by Berkson (p. 527); for, though the samples Fisher is thinking of have a total probability less than the critical value, these samples are none of them bad individually; they are, on the other hand, among the best obtainable; they are those that have the greatest probability. So a very large P is not to be interpreted as putting the stated hypothesis in jeopardy. It might cause one to lift the eyebrow a bit: perhaps it would pay to investigate another hypothesis, viz., that there may have been some unnoticed forcing of the sample to make it fit the universe. But the original hypothesis is not invalidated. Such things do happen.

A second corollary of this postulate is that, since nothing is said about accepting the hypothesis when P is larger than 0.01, we cannot prove by this means that it is to be accepted in such cases. It is only not to be rejected. Acceptance is to be at most tentative, or, in Fry's words, we have only an acceptable "working" hypothesis. Berkson says that it is hair-splitting to differentiate between this kind of tentative acceptance and final acceptance, but as we shall now see it is really useful to split this particular hair.

¹ Page 526.

² Page 513.

Berkson (p. 526) raises again the question mentioned by Fry with regard to large samples. Suppose (Fry's notation) the proportions in the universe being tested are p_1, \dots, p_s , and that for a sample of $m=200$, P equals 0.05, our critical limit being 0.01. Berkson makes the categorical statement that if m is large enough (say 20,000) then it will always happen that P is less than 0.01. But, if this be so, it only means that the universe being tested is not *exactly* the universe actually being sampled, and therefore we should naturally expect to find it rejected by a very large sample. The slight difference might not be detected when $m=200$, but would always be detected when $m=20,000$. This is not, however, a circumstance to "trouble the conscience of an honest statistician," any more than an honest carpenter should be troubled if he uses a level which is less accurate than the astronomer's level. When P was 0.05 we were not led to accept finally the hypothesis that the universe tested was the one actually being sampled. Our acceptance was tentative, and the way was left open for a possible final rejection by a later test. We knew initially that there might be a slight difference between the two universes which could not be detected by a small sample but could be by a sufficiently large sample.

The precise relationship between the size of such a sample and the size of the corresponding detectable difference is not yet known, I think; but it is easy to show that the following equation is approximately true. Let the proportions p_i in the universe being tested all be changed by the formulae:

$$dp_i = \pm \epsilon, \quad \sum dp_i = 0.$$

Then for a given sample the change in χ^2 is

$$d\chi^2 = -2m \sum_i \frac{n_i - mp_i}{mp_i} dp_i \quad (\text{Fry's notation}),$$

approximately, provided initially that the universe is acceptable and ϵ is very small. In a given case one can thus compute $|d\chi^2|$, but we may get a rough idea of its size now. Because the fraction is close to unity and because dp is equally often $+\epsilon$ and $-\epsilon$, it will almost always follow that $|d\chi^2| < m\epsilon$. As an example, suppose $m=200$, $s-1=14$, $\chi^2=15$, $P=0.38$. This implies an acceptable universe. We ask whether, by changing it by an amount $\epsilon=0.001$, it might be rejected by this sample. Since $d\chi^2 < (200)(.001)=0.2$, the answer is in the negative. But if m were 20,000, $d\chi^2$ might be as large as 20, making P as small as 0.002, and the answer would be in the affirmative.

A third corollary springs from the assumption that both the universe and the sample are to be specified by their relative frequencies

in the same finite set of categories, or cells. Fry's illustration of what would happen if the number of cells were reduced to two proves conclusively that when the number is changed, the problem itself may be altered, and the answer different from what it was. This point was not made in Pearson's initial account, and there are many examples in texts and elsewhere in the literature which seem to imply that, in testing curve-fitting by this means, the chi-square test does something more than what has just been stated, but it certainly does not. One must bear this in mind in considering the judgment Berkson makes in the early part of his paper about fitting the normal curve. For such cases are not tests of the hypothesis that the universe is exactly a normal curve, but rather of the hypothesis that the universe has the various categories in the proportions indicated by the various partial areas under that curve, and over the class intervals employed. The correctness of this interpretation is evidenced by the fact that in calculating the test one makes no use of the curve itself other than to take account of the several areas mentioned. Therefore every other curve which has these same partial areas is being tested as well as the normal curve. In other words, no "curve" is being tested, only the specified set of areas. With this point in mind, let us consider Berkson's remark about the third diagram for which $P=0.02$, $N=254$. What this result means is that, if one should select a sample of 254 from a universe in which the proportions in the several class intervals were equal to the areas under that normal curve, only 2 per cent of such samples would be as bad as this one. Hence, if one's limit of acceptance is greater than 0.02, as Berkson's seems to be, one would reject this hypothesis, and one would reject it even though the skewness of the sample were zero, and even though it had certain other characteristics of a normal distribution. Of course, one might have to accept it if no other "plausible" hypothesis would lead to a greater value of P , but clearly there are plenty of such other hypotheses. In fact, every non-normal curve whose several areas are exactly equal to the histogram sketched would yield $\chi^2=0$, $P=1$. Or is there a reason why *a priori* such curves are not "plausible"?

Identical considerations provide the answer, so it seems to this author, to Berkson's Poisson cases. Experiment I, for example, does not test whether the observations are from an exact Poisson distribution, but rather whether they come from the universe indicated by the frequencies opposite the word "Theory." For this latter universe s is about what it is for the sample, if in both cases one centers the frequencies at the numbers at the top, 1, 2, \dots , 12. Approximately, these two values of s are 2.40 and 2.32. But the s of the universe

sampled, 2.40, is not equal to \sqrt{m} ; $\sqrt{m}=2.46$. The point is then that the universe being tested is not necessarily Poisson. It is Poisson only with the understanding that the frequencies 6.92 and 8.07 are spread out in special ways instead of being centered at 1 and at 12. Such a spreading-out would increase the s of the universe from 2.40 to 2.46. But in that case the frequency 5 in the sample would have to be spread out similarly, and the s of the sample would be increased. It is true, however, that cases can arise in which P can be less than 0.01 by the chi-square test, and at the same time be greater than 0.01 by the s test, and *vice versa*, another reason why acceptance is to be tentative; or, as Berkson says, both tests are "specific": χ^2 is one parameter of the sample, and s is another. It might be necessary to test the sample by both methods, and also by still other methods. If one is to use only one test, and if the number of observations is sufficiently large to warrant the use of the chi-square test, it is usually to be preferred. For this test does separate into two groups all the samples according to the probabilities of those samples; but the s test separates all the samples into two groups according to the probabilities of their respective s 's. Since there exist some very improbable samples with very probable s 's it is clear that these two tests do not give the same value of P .

The application to tables such as Berkson's Table I, on the effectiveness of the vaccine, is full of difficulties in interpretation. As Berkson says, a 2×2 table may be handled by the method of testing the significance of the difference between two proportions, and the results are exactly as in the chi-square test. Since the method of proportions has the advantage that, when correctly stated, it forces the attention on the precise conditions involved, let us now examine Berkson's table by that method. Also, to make the case a bit simpler, without doing violence to the real situation, let us suppose we have three tables: the first is exactly like Berkson's table for males; the second, a table for females exactly like the first; and the third, made by pooling these two.

(I) (Males)				(Same with letters)			
	Affected	Not Affected					
Expt.	57	13	70	$p'N'$	$q'N'$	N'	$p' = 0.814$
Control	72	8	80	$p''N''$	$q''N''$	N''	$p'' = 0.900$
	129	21	150	pN	qN	N	$p = 0.860$

(II) (Females) Same figures as in (I)

(III) (Males and Females)

(Same with letters)

	Affected	Not Affected	
Expt.	114	26	140
Control	144	16	160
	258	42	300

$p'M'$
 $p''M''$

$q'M'$
 $q''M''$

M'
 M'

$| pM$

$| qM$

$| M$

p', p'', p as in (I), $M' = 2N', M'' = 2N'', M = 2N$

There are three problems: (a) What is the probability P_a that in selecting a pair of samples of 70 and 80 respectively from a large universe in which $p=0.860$, one would get a difference in the proportions observed as great as in table I of males (or II of females), *i e.*, as great as $|p'' - p'| = 0.086$? The answer is: $\chi_a^2 = 2.28$, $P_a = 0.131$. (Berkson uses $\frac{1}{2} P$, being interested in the problem that $p'' - p' \geq 0.086$, but his explanation that the discrepancy he observed has to do with the use of the algebraic rather than the numerical difference will not hold,³ because we shall see that the discrepancy persists when the numerical difference is used.) (b) What is the probability P_b that a similar result would be obtained in the pooled table III? The answer is:

$$\chi_b^2 = 2\chi_a^2, \quad P_b = 0.033.$$

Because χ_b^2 is greater than χ_a^2 , and because the number of degrees of freedom remains equal to one, it is clear that always in cases like this P for the pooled table will be less than for either of the separate tables. This is true in spite of the fact that every number in the pooled table is exactly twice the corresponding number in the first table, but it is nevertheless a result that is entirely natural. It is analogous to the fact that a throw of at least 6 heads with 8 coins is less likely than a throw of at least 3 heads with 4 coins. (c) What is the probability that in selecting a *pair* of samples of 150 each one would get as bad a *pair* as the two observed tables I (males) and II (females)? To answer this question we should first find the probability of the first pair and then add together the probabilities of all pairs whose probabilities were as small as that; but it may be shown that the result of this process would be exactly the same as if one used the additive chi-square method for the two tables I and II. So we let $\chi_c^2 = \chi_a^2 + \chi_b^2$ and use two degrees of freedom: $P_c = 0.1054$. We now note (with Berkson) that $\chi_c^2 = \chi_b^2$, that is, that chi-square for the additive case is the same as for the pooled table, but that, since the number of degrees of freedom is increased, the value of P is increased. We note also that this effect

³ Unless he is referring also to the point made at the very end of this paragraph.

must always take place when a perfectly homogeneous table (p constant if the table be subdivided) is divided into any number of equal portions, and that the more portions it is divided into the greater the increase in P . This result is also to be expected, and for the following reason. In both cases we are seeking the probability of a chi-square as great as $2\chi_a^2$, but in the additive case we are including in our count some pairs of tables which would not be included in the pooled case. An example of this would be a pair in which $p' - p''$ was positive in the first component table and negative in the second, both values being large and equal numerically. The pool of such a pair would show $p' - p'' = 0$. In the additive case the probability of this pair would have to be included, because its additive chi-square would be large. In the pooled case its probability would not be included, for its chi-square would be zero. Again, an analogous experiment in coin tossing could be readily constructed.

In summary, then, one would conclude that Berkson's pooled table of males and females together gave him the information he desired, and that nothing was gained by splitting up the material into the two parts (except that he showed thus that the material was, in respect to differences due to sex, nearly homogeneous). The value of P which he found from additive chi-square is to be disregarded, having been made artificially large by the process of subdivision.

SOME THOUGHTS ON CURVE FITTING AND THE CHI TEST*

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1. (a) *No errors in the points. The number of points equals the number of parameters.* Consider the graph of

$$y = \phi(x; \alpha, \beta, \gamma),$$

the known function ϕ containing three parameters (or constants) α , β , and γ . Any three distinct points on the graph will return the three parameters to us, but depending on the nature of the function ϕ , it may be very difficult to carry out the solution for them. In case of

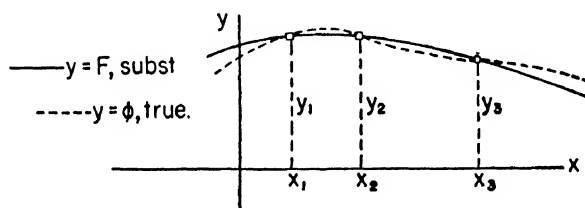


FIGURE 1
THE TRUE FUNCTION AND THE SUBSTITUTE FUNCTION; A TYPICAL SITUATION.

great difficulty it may be advisable to search for a substitute function F' such that the curve

$$y = F'(x; a, b, c)$$

passes through the three given points, the presumption being that the three parameters a , b , and c in F' can be found without much trouble in terms of the given coordinates. Then if the remainder or discrepancy

$$R(x) = F(x; a, b, c) - \phi(x; \alpha, \beta, \gamma)$$

between the two functions is within tolerable limits, and if possibly also their slopes or higher derivatives are not too discordant over the range of the points and for a short distance on either side, we may assert that F' is a satisfactory substitute or interpolation formula over this range. No general definitions of tolerable, too discordant, or satisfactory, can be laid down in advance; they will be matters of specification and personal judgment for each problem.

It is to be noted that in some circumstances, depending on the functions ϕ and F , the remainder $R(x)$ can be evaluated without great

* A paper presented at the Ninety-ninth Annual Meeting of the American Statistical Association, Atlantic City, New Jersey, December 27, 1937.

difficulty, or an upper limit found for it. In particular, if F is the polynomial $a+bx+cx^2$, the remainder is

$$R(x) = \frac{1}{3!} (x - x_1)(x - x_2)(x - x_3)\phi'''(\xi)$$

where ξ is intermediate between the greatest and least of x , x_1 , x_2 , and x_3 . But obviously the discrepancy $R(x)$ can not be evaluated unless something is known about ϕ .

1. (b) *No errors in the points. More points than parameters.* As has been remarked *any* three points on the graph of

$$y = \phi(x; \alpha, \beta, \gamma)$$

will suffice to determine the three parameters α , β , and γ , though for practical reasons it is advisable to avoid near indeterminacy by making sure that no two of the points are very close together.

But for the substitute function $F(x, a, b, c)$ we get one set of values for a , b , and c —*i. e.* one curve—from one group of three points, and usually another set of values—*i. e.* another curve—from a different group (two of which might in fact be members of the first). Given $n > 3$ points, we can find perhaps many F curves, but only one ϕ curve. Thus, when there are no errors in the points, the functions F and ϕ can be distinguished by noting which one can fit all the points simultaneously.

If there is a desire to use all n points and to obtain but one F curve, some method of compromise, such as least squares, will have to be adopted. The least squares criterion might take the form

$$\int [R(x)]^2 dx \text{ to be a minimum}$$

the integral being taken over the range of the given points. Here the square of the vertical discrepancy between F and ϕ has been minimized, but one might, with equal justification (if any), insist on minimizing the integral of the square of the horizontal discrepancy. Or, one might throw overboard any least squares criterion and use Tchebycheff's requirement that the maximum error in the vertical—*i. e.* in $R(x)$ —shall be a minimum.

2 *Errors in the points.* In practice the points that we have to work with are subject to error in one or both coordinates. In contrast with the situation in the preceding section, even if the correct function $\phi(x; \alpha, \beta, \gamma)$ is known, we can not hope to get the true values of α , β , and γ from three points or from all n points. It will now be impossible to distinguish the two functions F and ϕ on the basis that the latter will fit all the points, for it will not do so except by accident if $n > 3$, or in general, if n is greater than the number of parameters.

The relative weights of the observed coordinates may be known, in fact their standard errors may be known: in either of these circumstances a least squares or other adjustment is possible, by which the function $F(x; a, b, c)$ may be fitted to the observed points.

If the form of the true function ϕ were known, but not the parameters α, β , and γ , the formula

$$y = F(x; a, b, c)$$

to be fitted might be chosen identical in form with ϕ ; a, b , and c being estimates of α, β , and γ obtained in fitting. Often, unfortunately, the choice of F is not dictated by considerations of ϕ , which is too frequently unknown; lacking an adequate theory for the machinery back of the data we are forced to construct an empirical formula in an attempt to describe the data.

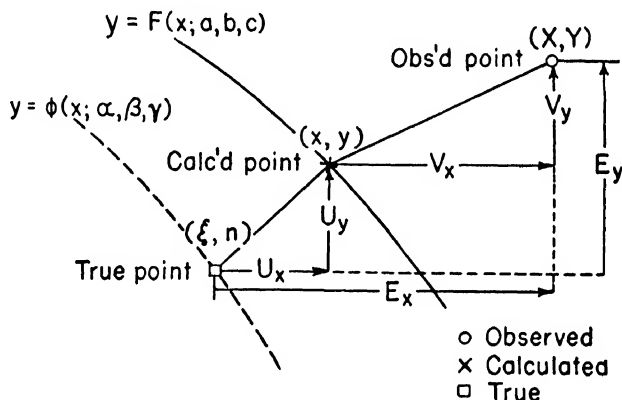


FIGURE 2

RELATIONS BETWEEN THE "TRUE," "OBSERVED," AND "CALCULATED" POINTS.

The x and y coordinates of a point are observed, these observations when plotted give the "observed point." The point that was measured is the "true point," which is unknown and lies on the unknown "true curve" $y = \phi(x, \alpha, \beta, \gamma)$. α, β, γ are the true but unknown values of the parameters. The "calculated curve" is found by adjusting the curve $y = F(x, a, b, c)$ to a series of observed points. Corresponding to each observed point there will be a "calculated point," whose coordinates are found by subtracting the "residuals" V_x and V_y from the observed coordinates X and Y . E_x and E_y denote the "errors in the observed point," U_x and U_y denote the "errors in the calculated point." E_x, E_y, U_x , and U_y are unknown, but V_x and V_y can be calculated along with the parameters a, b, c by the method of least squares. As the figure happens to be drawn, each of the six quantities $E_x, E_y, U_x, U_y, V_x, V_y$ is positive. Their signs are indicated by the directions of the arrows.

In the method of least squares we find the parameters a, b , and c that minimize

$$\chi^2 = \frac{1}{\sigma^2} \sum (w_x V_x^2 + w_y V_y^2)$$

for the given set of points, σ being the standard error of observations

of unit weight, w_x the weight of the x coordinate of some point, and V_x the x residual or x component of the line segment joining the observed and adjusted positions of that point. Similar definitions hold for w_y and V_y ; and the summation extends over all points.

3 *The distribution of chi-square.* On the assumption that the observations on the coordinates of the points are normally distributed about the true values, and that the residuals are not large, the distribution of the minimized chi-square for repeated samples of points is¹

$$p(\chi^2)d\chi^2 = \frac{1}{\Gamma(\frac{1}{2}k)2^{\frac{1}{2}k}} (\chi^2)^{\frac{1}{2}(k-2)} e^{-\frac{1}{2}\chi^2} d\chi^2$$

k being the number of "degrees of freedom," the number of points diminished by the number of adjustable parameters. As Fig. 2 illustrates, the residuals composing χ^2 are measured from the calculated points, which lie on the calculated curve.

The distribution of χ^2 just written holds *only if the fitted curve has the correct form* and is therefore capable of passing through the true points, in which case the average value of χ^2 arising from fitting the function F is theoretically equal to k . If any other function is fitted, the minimum χ^2 is, on the average, raised from k to some higher figure, depending on the degree of misfit.

It is instructive to hesitate for a moment on the simplest problem in curve fitting, that of n observations of equal weight on the same unknown magnitude μ , as depicted in Fig. 3. Here the y coordinate of any point is simply its ordinal number, and hence is without error. The x coordinates are supposed to be all of the same weight—unity for convenience. Here in this simple case the definition of χ^2 reduces to

$$\chi^2 = ns^2/\sigma^2$$

s being the S. D. of the n observations. \bar{x} , s , and χ^2 vary from one sample to another, whereupon the distribution curve for χ^2 gives immediately the curve for s . In deriving the distribution of χ^2 in 1900. Karl Pearson actually had the distribution of s in hand eight years previous to Student's semi-empirical development in 1908, both of them being antedated, however, by Helmert² who published the distribution of s in 1876.

¹ W. Edwards Deming, "On the chi test and curve fitting," this JOURNAL, 29 (1934), 372-382, "A new property of least squares," *Philosophical Magazine*, 19 (1935), 389-402. Occasionally the restriction that the residuals must be small can be removed, an example is the single sample of n observations (Fig. 3) for which $\chi^2 = ns^2/\sigma^2$, regardless of the size of the residuals.

² F. R. Helmert, *Astronomische Nachrichten*, Vol. 88, No. 2096, 1876. His development is reproduced in Czuber's *Beobachtungsfehler* (Teubner, 1891) pp. 150-163.

4. *The chi test for curve fitting.* Now if one is certain that his function F is the correct one, he would not be interested in knowing what χ^2 is, nor in making any statistical test of the function. But if he is not sure about this, he may be interested in considering how the value of χ^2 would be affected if he had been using the wrong function. He therefore makes the hypothesis that his function $F(x; a, b, c)$ is the correct one in form, recognizing as an alternative hypothesis the fact that the correct function may be something else. Since the alternative would, on the average, cause the value of χ^2 obtained from the

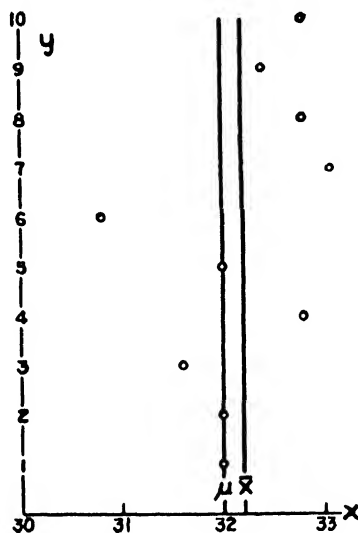


FIGURE 3
THE SIMPLEST ILLUSTRATION OF THE CHI TEST

Ten observations of equal precision are made, supposedly all on the same unknown magnitude μ , though this is just the proposition that is to be tested. If the observations are all on the same magnitude, then the "true points" are connected by the simplest of all relations, $x = \mu$. The y coordinates are here simply the ordinal numbers of the observations, and hence are without error. \bar{x} is the mean of the 10 observations, $x = \bar{x}$ is the "calculated curve," and $x = \mu$ is the "true curve." Here the chi test is merely a comparison of s with σ .

fitted function F to be higher than k , he would say that a high value of χ^2 is "evidence" that F is not the correct function. The usual tables of χ^2 and P enable one to see just how high his χ^2 really is, though in dealing with low degrees of freedom (small samples) one should bear in mind that neither the chi test nor any other test is very sensitive for detecting a false hypothesis, even in controlled experiments.

The minimized sum of weighted squares of residuals, $\sum (w_x V_x^2 + w_y V_y^2)$, is easily obtained in the solution of the normal equations, the procedure being well known, invented in fact by Gauss. Division by

σ^2 gives χ^2 , as seen from the definition of χ^2 at the end of section 2. If σ is not known, the chi test can not be used on a single function, though it is still possible to compare two functions, or two sets of parameters in the same function (next section).

5. *The estimate of σ by external consistency. Gauss' criterion.* Since χ^2 is on the average equal to k if the fitted function F is the correct one, it follows that an unbiased estimate of σ^2 obtained from the fitted points is

$$\sigma^2(\text{ext}) = \sum (w_x V_x^2 + w_y V_y^2)/(n - p).$$

Here n is the number of points, p the number of adjustable parameters (hitherto taken as 3 for illustration), and $n - p$ is the number k in the distribution of χ^2 previously written.³ This estimate of σ^2 is unbiased⁴ in the sense that the average of such estimates will theoretically be equal to σ^2 ; being based on the consistency of the points compared with the fitted curve, it has been called by Birge⁵ the "external" estimate, hence the notation just adopted.

If for brevity we now adopt the symbol S for the sum of the weighted squares of residuals, $\sum (w_x V_x^2 + w_y V_y^2)$, we may write simply

$$\sigma^2(\text{ext}) = S/k.$$

It has been remarked that when σ is not known, the chi test can not be used for a single function. The estimate $\sigma(\text{ext})$ is no help in this regard, because by its definition it leads invariably to the foreordained value k for χ^2 , and hence to a value near $\frac{1}{2}$ for P ; and this will be so whether the curve fits badly or well. The external estimate is accordingly useless for the chi test, since it gives a result that can be predicted with certainty before the observations are taken.

We must therefore look for an estimate of σ from other sources. Sometimes it is pretty well established from previous experience. Or, in well designed experiments, it is possible to make an estimate by what Birge calls "internal consistency"—i. e., by pooling the S. Ds. of several samples, each sample being made up from several observations on the same coordinate. Thus, if there are n_1 observations having S. D. s_1 , n_2 observations having S. D. s_2 , etc., we may take

$$\sigma^2(\text{int}) = \frac{n_1 s_1^2 + n_2 s_2^2 + \dots + n_m s_m^2}{n_1 + n_2 + \dots + n_m - m}$$

³ Gauss himself subtracted p from n to get the corrected number of degrees of freedom for an unbiased external estimate of σ^2 , the reference is to Art. 11 in his *Supplementum Theoriae Combinationis* (Göttingen, 1823).

⁴ The term unbiased is used in a different sense by E. J. G. Pitman, *Proceedings of the Cambridge Philosophical Society*, 33 (1937), 212-222.

⁵ For some history and references see my *Least Squares* (The Graduate School, Department of Agriculture, 1938) pp. 18 and 164.

for another estimate of σ^2 , also unbiased in the same sense as the external estimate is unbiased. m is here the number of samples that are combined to make the one estimate $\sigma(\text{int})$. Having both $\sigma(\text{ext})$ and $\sigma(\text{int})$ one may calculate Fisher's

$$z = \frac{1}{2} \ln \sigma^2(\text{ext})/\sigma^2(\text{int})$$

and use this as a criterion for testing the goodness of fit of the curve. The z test replaces the chi test when σ is not definitely known from other sources, such as from previous experience. The numbers n_1 and n_2 in Fisher's tables of z will be $n-p$ and $n_1+n_2+\dots+n_m-m$, respectively.

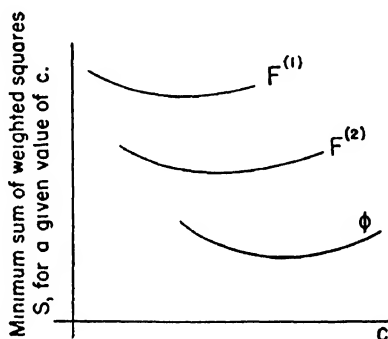


FIGURE 4

For each value of c , the sum of the weighted squares S is minimized with respect to a and b in the fitted function, and the value of S so obtained is plotted against c . The resulting curve passes through a minimum at the least squares values of a , b , and c . Here the minimized S is shown for the true function ϕ and for two substitute functions $F^{(1)}$ and $F^{(2)}$. The lowest point on the curve for ϕ is the minimum minimorum.

Owing to the fact that a high value of χ^2 is to be taken as statistical evidence that the fitted function F may not be the correct one (section 4), it follows that of two functions, or of two sets of parameters (say a_1, b_1, c_1 and a_2, b_2, c_2) for the same function, that which yields the smaller value of $\sigma(\text{ext})$ from a given set of points will have statistical preference for this set of points. This is Gauss' criterion of comparison. Since σ is a property of the observations, and not of the curve fitted to them, this criterion reduces to a comparison of two values of S (defined above).

Corresponding to a fixed value c_1 of c , there will be an a_1 and b_1 that make S as small as possible for the given set of observed points and the fitted function F . Likewise, for the value c_2 of c , there will be the values a_2 and b_2 that minimize S . Clearly, S will be a function of c , passing through a minimum at the least squares values of a , b , and c .

The shape of the curve will be nearly a parabola near the minimum. The uppermost curve in Fig. 4 shows such a plot of S for a function $F^{(1)}$. Equally, for some other function $F^{(2)}$ and the same set of points, there will be another curve for S , having similar shape, but lying more or less distant in the vertical from the first one. If the two functions are of differing types, as might be the case if they arose from different theories, and if k is large, then the vertical separation of the S curves in Fig. 4 will be relatively large compared with the change in S that is brought about by changing the parameter c through an appreciable fraction of its standard error, in either one of the two functions.

From these considerations one may conclude that Gauss' criterion is sensitive for comparing two different types of functions, but not so sensitive for comparing two values of a parameter in the same function.

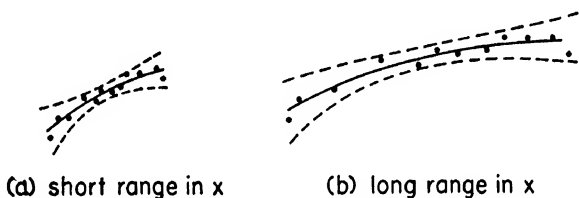


FIGURE 5

TWO RANGES IN x , BOTH GIVING THE SAME χ^2 AND P . THE DASHED CURVES SHOW THE 95 PER CENT CONFIDENCE BANDS

Gauss' criterion for comparing two functions, or two sets of parameters in the same function, is to be used only when one is satisfied that the residuals are random. If the departures of the observed points from the fitted curve are systematic, as happens when a simple smooth curve can be drawn through the plot of deviations or residuals, then no matter what be the value of χ^2 or $\sigma(\text{ext})$, one can say at once that some other curve or further modification is required for an adequate expression of the relation existing between x and y .

6. *One further remark.* Fig. 5 shows two fitted curves, the points for one curve covering a short range in x , and for the other, a long range; the observed points, furthermore, being such that the values of χ^2 and P reckoned from them are the same for both curves. It will be agreed, I think, that there is less information contained in the short curve, in the sense that an extrapolation to the range that is successfully covered by the long curve might well be considered hazardous. Yet, as noted, both curves with their respective sets of points give the same values of χ^2 and P , and hence of $\sigma(\text{ext})$; both curves, so far as the chi test is concerned, fit their respective sets of points equally well. But the chi test takes no account of future points that may be observed

outside the range already covered, nor how those future points will lie in relation to the extrapolated curve. In the case of the curve covering the long range of points there is nothing to conjecture concerning the range already covered.

The confidence bands⁶ of the curves lead to substantially the same impression; the cornucopia effect is not nearly so pronounced over the long range curve, and this fact signifies that greater confidence can be placed in the ends of curve *b* than could be placed in curve *a* if it were extrapolated to the same length as *b*.

In conclusion it is a pleasure to speak of the stimulating conversations that I have had with my friend Mr. F. F. Stephan, particularly with respect to the last section; also to mention some helpful suggestions from Professor Burton H. Camp.

⁶ A confidence band for a curve is measured off as some multiple of the standard error of the calculated y , a convenient reference for which is Henry Schultz's article "The standard error of a forecast from a curve," this JOURNAL, 25(1930), 139-185. The vertical distance between the dashed curves of a 95 per cent confidence band is equal to $2t_{.025}$ times the estimated standard error of the calculated y , $t_{.025}$ being obtained from Fisher's tables or otherwise, as from Nekrassoff's nomograph in *Metron*, Vol. 8 (1930), No. 3. Pages 115 and 116 of my *Least Squares* mention some other features of confidence bands.

PUNCHED CARD TECHNIQUE FOR THE CORRECTION OF BIAS IN SAMPLING

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1. INTRODUCTION

THE method of stratified sampling has, during the past few years, come into extensive use in the sampling of human populations. The present paper does not undertake to extend the theory of stratified sampling, but to describe a technique for its application by means of the punched card method. This technique is also applicable to non-random samples, even if not secured by the method of stratified sampling as strictly defined. This procedure, it is thought, should be useful in studies which involve the analysis of a great quantity of data.

This technique was developed for the analysis of data from the Motor Vehicle Allocation Study, one of the studies conducted by the Texas Highway Planning Survey. The method of stratified sampling was not used in the selection of the sample. The object of this study is to obtain the distribution of certain variates associated with motor vehicles, or the owners of motor vehicles. It is desired to determine for each population group in the State the number of motor vehicles of each type whose owners are resident in that group, as well as the amount of gasoline taxes and license fees paid by such owners and other information of similar character. To obtain these data, questionnaire cards were distributed to the motor vehicle owners at the offices of the county tax collectors at the time of payment of the annual license fees. The rate of return of questionnaire cards thus varies considerably from one county to another. It is suspected, furthermore, that elements of bias may enter into the distribution within a county,—that, for example, residents of rural areas may return the questionnaire cards less well than urban residents. For this reason, it was found desirable to determine a group of controls for the preparation of “unbiased” estimates of the distribution of the desired variates in the total population of motor vehicles. The large size of the sample, over 350,000 questionnaires, required the use of the punched card method for preparing tabulations. A technique was devised for preparing, directly from the punched cards, tabulations properly adjusted to the level of the total population of motor vehicles, with the elements of bias, so far as possible, corrected. By this method, it is as easy for the tabulating machines to produce figures which represent estimates of the distributions of the required variates in the population as it is to prepare similar figures for the sample.

2 STATISTICAL METHODS

The method of stratified sampling has been developed in the past few years by Bowley, Neyman, and others. A mathematical formulation of the method is presented by J. Neyman in his paper, "On Two Different Aspects of the Representative Method."¹ The present technique represents an application of the method as formulated by Professor Neyman. This method will be described briefly in general terms. Suppose that we have determined a group of variates, which Professor Bowley has called controls, whose distributions in the sample are biased or suspected of bias, and which are correlated with the variate or variates whose distributions in the population it is desired to determine. It is assumed that the distribution of the control variates in the population is known from previous studies based on complete compilation of data or on large samples.² Each control variate is divided into a series of intervals, and each combination made up of one interval of each variate defines a stratum which we may think of as a cell in n -dimensional space, where n denotes the number of control variates.

Suppose that for each i ($i=1, 2, \dots, k$), M_i represents the number of elements of the population and m_i the number of elements of the sample in the i th stratum. Suppose that x_{ij} represents the value of the variate x corresponding to the j th element of the i th stratum. Suppose that θ denotes the sum of the values of the variate x in the population, and θ' , the best linear estimate of that sum. Neyman has shown that θ' is given by the following equation:

$$\theta' = \sum_{i=1}^k \sum_{j=1}^{m_i} (\lambda_i x_{ij})$$

where, for each j , $\lambda_{ij} = \lambda_i = M_i/m_i$.

The application of these coefficients, $\lambda_i = M_i/m_i$, which might conveniently be called expansion factors, by means of the punched card method will be described in the next section of this paper.

3 PUNCHED CARD TECHNIQUE

For each questionnaire card, a tabulating card is punched. On this card are punched the values of the different variates which it is desired to sample, as well as certain other variates which it is expected will be used as controls. It is assumed that we have reliable control information concerning the distribution in the population of the control variates. This information would probably be compiled in the form of a two or more dimensional correlation table. Information in similar

¹ *Journal of the Royal Statistical Society*, 97 (1934), 558-625.

² Cf. J. Neyman "Contribution to the Theory of Sampling Human Populations," this JOURNAL, 33(1938), 101-116

form pertaining to the distribution of the control variates in the sample is provided by proper sorting and tabulating of the punched cards. By referring to these two collections of information, one for the population and the other for the sample, the coefficients $\lambda_i = M_i/m_i$ are calculated for the various strata.

For each i , the coefficient λ_i is punched in a vacant field of each of the tabulating cards in the i th stratum. The tabulating cards will already have been sorted in proper order in preparing the tabulation just described. The coefficients can most conveniently be punched into the cards by means of the gang punch. The coefficient for each stratum is manually punched into a master card, from which it is automatically punched into all the data cards for that stratum.

Suppose now that we wish to prepare a frequency distribution of one of the variates punched in the tabulating cards which will represent the estimated distribution of that variate in the population. To do this the cards are sorted and tabulated as they would be for preparing a similar frequency table for the sample, except that instead of having the tabulating machine count the cards in each interval, we have it tabulate the coefficients, or expansion factors, which have just been described. We can, if we so desire, have figures for the unexpanded sample in one column and figures for the expanded sample in an adjacent column.

Suppose, furthermore, that we wish to produce an estimate of the average value of one of the variates in the population. We can accomplish this end most expeditiously by means of an Automatic Multiplying Punch. In producing such an average, this machine serves a function corresponding to that of the tabulating machine in producing an average based on the sample. The Automatic Multiplying Punch can be used to multiply the value of the desired variate by the expansion factor in the same card, and accumulate the sum of all these products in a counter on the machine. If now we divide this sum of products by the sum of the expansion factors for the same group of cards, we obtain a properly weighted average which represents the estimate of the average in the population. If, however, an Automatic Multiplying Punch is not available, an estimate of an average for the population can be prepared in the usual way from a frequency table, except that the frequencies are obtained by tabulating the expansion factors as described in the preceding paragraph.

4 APPLICATION

The discussion of an application of this method will be limited so far as possible to a discussion of the punched card technique that has

just been described without entering upon a discussion of the adequacy of the control variates employed. In the analysis of the portion of the Motor Vehicle Allocation Study pertaining to passenger cars, the controls employed are (1) county and (2) year model of car. If we assume that we are dealing with only one county, say Anderson County, then we have only one control, namely, year model, to think of. It has been found that the owners of the older vehicles (1) tend to return the questionnaire cards less well and (2) tend to travel fewer miles per year, with an approximately linear regression in each case.³

For control information, tabulations⁴ showing the registration of passenger cars by year models within each county were used. Tabulations were prepared showing the distribution of the sample by year models within each county. By calculating the ratio of each registration figure to the corresponding sample figure, expansion factors were obtained for each year model within each county. For Anderson County, the following table was obtained:

Year model	Passenger car registrations	Passenger cars in sample	Expansion factor
1937	443	81	5 469
1936	721	269	2 680
1935	511	207	2 469
1934	497	166	2 994
1933	405	121	3 347
1932	170	63	2 698
1931	361	72	5 014
1930	338	89	3 798
1929	557	106	5 255
1928	261	39	6 692
Prior to 1928	269	37	7 270
Total	4,533	1,250	3 626

These factors were manually punched on master cards, and from these automatically punched into vacant columns in the data cards by means of the gang punch. By this means, the factor for Anderson County, 1937 model, is punched in all the passenger car data cards for that county and year model.

In order to obtain the distribution of the passenger cars by (human) population groups for the State as a whole, the cards are sorted by population groups, but instead of counting the cards in each group, the expansion factors are totalled for each group. To obtain the average miles traveled for a given population group (for example, places, 1,001 to 2,500 population), the cards for that group may be run through the Automatic Multiplying Punch which multiplies the miles traveled by

³ These facts have been observed by representatives of the Bureau of Public Roads in other states. They have been confirmed in Texas

⁴ Prepared by the Reuben H. Donnelley Corporation, 350 East 22nd Street, Chicago, Ill

the expansion factor on each card and accumulates the sum of these products in a counter on the machine. If this sum of products is divided by the sum of the factors for the same group of cards, an average miles traveled figure for that group is obtained. If an Automatic Multiplying Punch is not available, we may use a tabulating machine to prepare a frequency table showing the (expanded) number of vehicles for each coded interval of miles traveled. The frequencies are obtained by totalling the expansion factors for each interval. From this frequency table, the arithmetic mean can be calculated in the usual way. A similar procedure is employed for other variates, such as gasoline consumed and license fees paid

THE PROBLEM OF THE STOCK PRICE INDEX NUMBER*

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STUDENTS of index number theory cannot fail to recognize the tremendous debt they owe Irving Fisher for his services in the advancement of this field of statistical analysis. It may not be an exaggeration to say that index number science received its greatest single stimulus when Irving Fisher directed his talents toward *The Making of Index Numbers* ¹

Recognizing this obligation, one must nevertheless voice a criticism of his purely formal approach to the selection of a "best" formula. Given that an investigator wishes to measure price movements, Fisher holds there is just one "ideal" formula, and it is expressed by

$$(1) \quad I_i = \sqrt{\frac{\sum p_i q_0}{\sum p_0 q_0} \frac{\sum p_i q_i}{\sum p_0 q_i}},$$

where the p 's and q 's are prices and quantities, respectively, the subscript 0 denotes the base period, the subscript i denotes the given period for which an index is sought, and the \sum denotes summation over all the items included in the index.²

This "ideal" formula is selected without regard for the nature of the data or the objective of the statistical analysis for which its use is recommended. It meets two formal "reversal tests" and is somewhat less complex than any of the other twelve indexes (among some two hundred considered) which also satisfy these tests.³ This is the sole basis of its selection. In fact, the objectives of the analysis are explicitly scorned.⁴

The contrary hypothesis here urged is that it is necessary to consider the purpose for which an index is to be constructed, in the selection of the appropriate formula. Only the recognition that computers are today justifying their index number formulas on the ground that they approximate the "ideal" justifies the reaffirmation of this point which has been so ably made throughout the literature of statistics. Thus Yule says, "Professor Fisher's belief that he is able to give the correct answer to a question without knowing what the question is

* I wish to express my indebtedness to Mr. Alfred Cowles III, President of the Cowles Commission for Research in Economics, for permission to include in this paper some of the material prepared in connection with a forthcoming publication of the Commission, *Common-Stock Indexes, 1871-1937*, and for suggestions helpful in that preparation.

¹ Irving Fisher, *The Making of Index Numbers* (3rd ed., New York: Houghton Mifflin, 1927).

² *Ibid.*, p. 221.

³ *Ibid.*, pp. 219-222.

⁴ *Ibid.*, p. 229.

does not appear to me well founded."⁵ And again, "so far from ignoring the purpose of the index number, we must start from the purpose in order to deduce the formula required."⁶ Mitchell, too, believes Fisher's position is "untenable."⁷

Bowley attacks the logic of the two reversal tests, and says they depend "simply on the author's [i.e., Fisher's] opinion that the nature of the problem or data cannot affect the question which is the best form for an index."⁸

Belcher and Flinn take a similar position in their review: "As a useful instrument an index number implies a purpose, and for different purposes the requirements are dissimilar."⁹ And King says, perhaps a bit optimistically, "Once the query is made specific, the answer can also be made definite and conclusive."¹⁰

If this thesis be accepted, our attention may properly be turned to the consideration: What question do we *want* to answer by means of a stock price index number? We might wish to know the simple average price per share (A) of a representative list of n stocks, so that the expenditure of nA dollars on the date for which the average was calculated would purchase a single share of each issue on the list. If so, the Dow-Jones average as calculated prior to 1928 ($A_1 = \sum p_i/n$) is clearly indicated.¹¹

We might prefer to know the current value (nB_1) of the portfolio of an investor who purchased one share of each of the n issues on some base date, and held them continuously to the present time. The "average" relevant to this query is simply $B_1 = \sum p_i/cn$, where c is the correction applied to the denominator to compensate for any changes which may have occurred in the numerator prices due to stock dividends, splits, or the issue of rights. This is the type of formula used for the Dow-Jones averages subsequent to September 10, 1928, but since c was adjusted so as to make the average the same for September 8, 1928, whether computed by the old or new formula, it appears impossible to assign a base date to which the present Dow-Jones averages may be said to refer.

⁵ G. U. Yule, *Journal of the Royal Statistical Society*, 86 (1923), p. 425. The student who has not made the acquaintance of this sprightly review of Professor Fisher's book is urged to discover Yule's facile and sometimes sharp pen without delay.

⁶ *Ibid.*, p. 427.

⁷ Wesley C. Mitchell (U. S. Bureau of Labor Statistics Bulletin No. 284 [1921]) p. 23.

⁸ A. L. Bowley, *Economic Journal*, 33 (1923), p. 93.

⁹ Donald R. Belcher and Harold M. Flinn, this *JOURNAL*, 18 (1923), p. 930.

¹⁰ Willford I. King, *Index Numbers Elucidated*, (New York: Longmans, 1930) pp. 30-31.

¹¹ Before September 10, 1928, occasional corrections were made in the Dow-Jones averages by introducing a multiplier in the numerator of A_1 for the price of an individual issue which had been split up, but this was evidently somewhat haphazard. See *The Dow-Jones Averages* (8th ed.; New York: Barrons, 1938).

The question might also be asked: What was the average price per share (C_i) paid by purchasers of the n issues during period i ? This calls for a weighted average, $C_i = \sum p_i q_i' / \sum q_i'$, where the q_i' are the number of shares of each of the n issues *traded* during the period in question.

However, none of these questions is the one of chief importance to the typical individual investor, who holds neither one share of each issue nor a portfolio distributed among the several issues in proportion to their volume of trading on a particular day. He wants a measure of the current value of his holdings compared with their value in some base period. For common stock investors as a group, this current value of holdings is simply $\sum p_i q_i$, where the p_i are the prevailing per share prices of all common issues, and the q_i are the numbers of shares of each issue *outstanding*. Similarly, the corresponding base period value is given by $\sum p_0 q_0$. Consequently the ratio of these values indicates the relative worth of all common stock investors' holdings, as compared with the value of such holdings on the base date, and the indicated index is

$$(2) \quad I_i = \sum p_i q_i / \sum p_0 q_0.$$

Formula (2) is the familiar value ratio of index number theory. Irving Fisher employs it to obtain index number formulas which satisfy the "factor reversal test"¹² and praises it as a useful statistic in no uncertain terms: "The value ratio . . . is not debatable It is an incontrovertible fact. There is only one value index, and it has no fringe of doubt whatever."¹³

Frisch's paper¹⁴ also imposes the condition on any pair of price and quantity index numbers, that their product shall equal the value ratio; and J. K. Montgomery's recent work,¹⁵ employing the same principle, makes the value ratio the basis of the entire process of formula development.

However, the suggestion that formula (2) itself be used as an index number is definitely unorthodox. Thus Fisher says, "Properly speaking, this value index . . . is not an index at all . . . ; for it is not an average of anything."¹⁶

Now it is precisely this feature (i.e., it is not an "average") which commends the value ratio as a stock price index number. If the index were an average of actual prices, however weighted, it would reflect price changes which are of no significance to the investor, since, e.g.,

¹² Op cit, pp 125 ff

¹³ Irving Fisher, "The Total Value Criterion," this JOURNAL, 22 (1927), p 425

¹⁴ Ragnar Frisch, "Necessary and Sufficient Conditions Regarding the Form of an Index Number which Shall Meet Certain of Fisher's Tests," this JOURNAL, 25 (1930), pp 397-406

¹⁵ *The Mathematical Problem of the Price Index* (London P S King and Son, 1937)

¹⁶ "The Total Value Criterion," loc cit

every stock dividend reduces such an average, although the investor has thereby suffered no loss whatever. Price alone has no such significance for common stock holders as for holders of commodities. Further, it seems reasonable to take formula (2), which measures an aggregate of investment experience, as the best measure of the average experience of the individual investor. It should be pointed out in this connection that the issues on which formula (2) is computed should constitute as nearly as possible a census of common stock investment opportunity. If it is impossible to secure nearly complete coverage of the value of outstanding issues, the sample must be selected with great care to avoid attaching too heavy a weighting to those issues with a long and active trading record.

No stock price index number formula with which the writer is acquainted escapes the necessity of some corrections for changes in the capital structure of a corporation whose issues are included in the index. But the value ratio preserves a certain consistency with regard to these corrections. As already noted, the price changes consequent upon a stock dividend or split are of no moment to the investor. The value ratio requires no adjustment for stock dividends or splits. On the other hand, the sale of additional stock by a corporation, through rights issue or otherwise, increases the value of outstanding stock, but reduces the proportionate claim of the individual investor against the corporation's earnings. The value ratio does require correction for the sale of new stock.

This correction is very simple. If the companies selling additional stock between the base period and period i realize s_i per share on their new shares issued, the current value of stock outstanding ($\sum p_i q_i$) overstates by $\sum s_i(q_i - q_0)$ the worth of the shares held in the base period. The corrected index then becomes

$$(3) \quad I_i = \{ \sum p_i q_i - \sum s_i(q_i - q_0) \} / \sum p_0 q_0.$$

It may be objected that the value ratio ought not be called a stock *price* index, since it measures values (i.e., prices times quantities) and not prices alone. This is a valid objection, but against it must be set the terminological precedent established by the well-known and currently published stock price indexes (so-called) which recognize the necessity of correcting the observed prices whenever these prices fail because of changes in capital structure to reflect investor experience. Since the purpose of most (it seems fair to say all) stock price indexes is to reveal investment experience, rather than the actual course of prices, it is not unreasonable to apply the name "stock price index" to the value ratio so employed.

The only other type of correction which our index requires is that

for the inclusion of a new stock, or removal of an old issue. The value added to the numerator of (2) when the list of included issues is expanded is no profit to the individual investor; nor does he suffer any loss because it is decided to withdraw the shares of some company from the index. Consequently, the new issue added or old issue withdrawn must not be permitted to affect the index for the period in which the change (in included issues) is made.

This adjustment may be accomplished in at least two ways. A multiplier may be applied to the denominator of (2), such that the index for period i will have the same numerical value as though the list of included issues had not been changed. This is the method employed by the Standard Statistics Company ¹⁷

An alternative method is the construction of a "chain" index number. In the explanation of this method, it will be helpful to define $\sum^j p_i q_i$ as the value in period i of those stocks which are *effective* in period j . A stock is effective in period j if its price in period j is permitted to affect the index for that period. A series of links may be formed, each expressing the ratio of the value of effective stocks in a given period to the value of the same list of stocks in the preceding period. Any individual link would be

$$I_i' = \sum^i p_i q_i / \sum^i p_{i-1} q_{i-1}.$$

If these links are chained by product cumulation we have

$$\begin{aligned} I_i &= I_1' I_2' \dots I_i' & I_i' &= \frac{\sum^1 p_1 q_1}{\sum^1 p_0 q_0} \frac{\sum^2 p_2 q_2}{\sum^2 p_1 q_1} \dots \frac{\sum^i p_i q_i}{\sum^i p_{i-1} q_{i-1}} \\ (4) \quad & & &= \prod \frac{\sum^i p_i q_i}{\sum^i p_{i-1} q_{i-1}}. \end{aligned}$$

As long as each link of (4) contains the same list of stocks in its numerator as in its denominator, it is clear that such list may be changed in every period without thereby introducing any arbitrary gains or losses in apparent investor experience.

Finally, the correction contained in formula (3) may be made a part of (4), thus expressing the index in its most general form. This yields

$$(5) \quad I_i = \prod \frac{\sum^i p_i q_i - \sum^i s_i(q_i - q_{i-1})}{\sum^i p_{i-1} q_{i-1}}.$$

¹⁷ See any base book of the Standard Statistics Company

An investor is "average" in the sense of formula (5) if he holds, during each period, all of the issues effective in that period, in proportion to the total value of each issue outstanding. Thus (5) becomes a more realistic measure of investment experience, the more nearly the list of effective stocks represents all outstanding issues. It therefore seems reasonable to attach more reliance to indexes which strive to make a census of the market, than to indexes which merely sample the market with 20 or 30 active issues. Thus in the period 1871-1917, the Cowles Commission Indexes are based on every industrial and public utility issue quoted on the New York Stock Exchange for two or more consecutive months, as well as 80 per cent (in value) of the railroad shares. Among regularly and currently published indexes which measure investment experience, the Standard Statistics indexes are rather in a class by themselves, with more than 400 issues whose total value is 90 per cent of that of all common stocks listed on the Big Board.

While formula (5) seems the simplest way of calculating the stock price index here advocated, identical results have been obtained by the Standard Statistics Company, using a so-called "fixed base" formula which may be expressed, in our notation, by

$$(6) \quad I_t = \sum p_t q_t / \prod c_t \sum p_0 q_0$$

where, as before, $\prod c_t = c_1 \cdot c_2 \cdot \dots \cdot c_t$. With this formula, the procedure is simply to calculate a multiplier c for each period in which there is a sale of additional stock by any of the included corporations, or a change in the list of included issues. This multiplier is so chosen that the sale of stock or change in list of stocks will not affect the index for the period in which they occur. Of course, if no sale or change takes place, $c=1$ for that period. Unless $c_1=c_2=\dots=c_t=1$ it is scarcely accurate to call (6) a "fixed base" index number, although the fact that a daily or weekly index may frequently be calculated according to (6) for several months without the necessity of altering the denominator has doubtless given rise to the use of the name.

Prior to 1926, the Standard Statistics Company made its corrections for the sale of additional stock by computing for the numerator of its index a "corrected quantity weight" (say q_t'') which when multiplied by p_t yielded an adjusted value of stock outstanding ($p_t q_t''$) actually equal to $p_t q_t - s_t(q_t - q_{t-1})$. Since this corrected quantity weight had to be recomputed not only for every sale of new stock but also for every stock dividend, considerable labor was involved and the numerator of the index departed further and further from the actual value

of outstanding stock. Because of these objections, formula (6) was adopted.¹⁸

It may be interesting to note that the U. S. Bureau of Labor Statistics has used what is substantially formula (4) as its wholesale price index for the 29 years 1908-1936, but is just now adopting the method of adjusting numerator quantity weights whenever changes are made in an individual price series.¹⁹

Since it is the thesis of this article that in index numbers one man's meat is another man's poison, there is no intention of judging this change to be unwise, but the new B. L. S. method does seem to involve a rather awkward procedure.

It should be noted, in conclusion, that this paper neglects completely the brilliant recent work of Allen, Bowley, Frisch, Lerner, Stachle, and others in the field of price of living index numbers, not because the author is totally unaware of these contributions, but because such study as he has been able to make of them reveals no point at which they offer assistance in the problem of measuring investment experience in common stocks. For excellent examples of "purposeful" index numbers, however, the reader can find no better source than these discussions carried on in the various journals, chiefly perhaps the *Review of Economic Studies*, and summarized through 1935 by Frisch in the January, 1936, *Econometrica*.

SUMMARY

It is the argument of this paper that: the selection of an appropriate index number formula involves consideration of the purpose for which the index is to be employed; that the real purpose of all so-called stock price indexes is to measure not stock prices but investment experience; that the best measure of investment experience is the familiar value ratio, with simple adjustments for changes in capital structure and in the list of issues included in the index; and that the chain index formula seems the most facile in handling these corrections.

¹⁸ See any base book, or the mimeographed description of the calculation of the Standard Statistics Indexes, prepared about 1933 and distributed by the Company

¹⁹ See J. M. Cutts and S. J. Dennis, "Revised Method of Calculation of the Wholesale Price Index of the United States Bureau of Labor Statistics," this JOURNAL, 32 (1937), pp. 663-674. The authors of this paper imply (p. 667) that both numerator and denominator quantity weights of their formula $I_k = 100 \Sigma(P_k Q_k) / \Sigma(P_0 Q_k)$ (where k denotes the given month, 0 the base period, and h some census date) are changed whenever a substitution (e.g., the replacement of price quotations on "Amalia" currants by those on the "Patras" variety) is made. Yet they call their formula a weighted aggregative with a fixed base. Not only does it seem a tremendous task to recompute the base value for every such substitution, but also it is not clear why such recomputation should be desired, if the value expressed by the numerator of I_k has been "adjusted so that [it is] comparable . . . with preceding periods."

PROBLEMS IN THE MEASUREMENT OF THE PHYSICAL VOLUME OF OUTPUT, BY INDUSTRIES*

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THIS paper is devoted to problems arising in the measurement of the physical volume of output of individual industries, not of the output of individual goods. The problems considered include: the definition of output of an industry; the measurement of output of industries incompletely reporting quantities; the place of the output of the service industries in indexes of production; and the formula and weighting scheme logical for use in combining the output of several industries. Perennial problems such as those related to the definition of an industry are not considered here. Because aggregation of quantities *per se* is not valid, by physical output we mean value of product with prices held constant.¹ An index of this value may be derived either by going directly to the physical quantities and multiplying each by the corresponding constant price, or by deflating the index of current value of product by an appropriate price index. The two methods yield identical results if the prices used in the price index relate to the same quantity units as those used in the quantity index; if appropriate formulas are used; and if the commodities covered by both methods are the same.²

OUTPUT OF INDIVIDUAL GOODS AND OUTPUT OF INDIVIDUAL INDUSTRIES

The physical volume of output may be considered in terms of finished products—boots and shoes, motor cars, machinery;³ or in terms of the productive activities of industries—the output of the leather industry, of the boot and shoe industry, of the retail shoe store. It is desirable to identify the total physical volume of output based on the aggregate of finished products (including changes in inventories and the net difference between exports and imports) with the aggregate of the outputs of single industries. The distinction between the con-

* I wish to acknowledge the helpful comments of Milton Friedman and William H. Shaw.

¹ Cf. A. F. Burns, "The Measurement of the Physical Volume of Production," *Quarterly Journal of Economics* (February, 1930).

² The desired quantity index is $\Sigma q_i p_i / \Sigma q_i p_i$. This index may be obtained either directly, or by deflating the relative of values, $\Sigma q_i p_i / \Sigma q_i p_i$, by $\Sigma q_i p_i / \Sigma q_i p_i$. Lack of data may force the use of a price index derived by the formula $\Sigma q_i p_i / \Sigma q_i p_i$, in this case we have only an approximation to the desired price index and the derived quantity index may differ somewhat from one that would be obtained directly from the quantity data.

There is nothing specially accurate about base year prices, of course. Efforts should be made to check results by using given year prices as well.

³ Cf. Simon Kuznets, *National Income and Capital Formation* (National Bureau of Economic Research, 1937), Part VI.

cepts then becomes significant only when the aggregates are broken down.⁴ If we wish to discuss output classified by ultimate use or durability, the concept of output of finished products is the suitable one. Only a finished product is clearly classifiable in this way. Unfinished goods (steel, for example) may be used in products of diverse degrees of durability and devoted to diverse uses. If we wish to measure the output of individual industries (for example, in order to compare output with employment), the second concept is more appropriate, for it is difficult to determine the number of workers devoted to each finished product in an industry that may be turning out several commodities (some of which may be unfinished).

MEANING OF OUTPUT OF AN INDUSTRY⁵

The output of a single industry may be conceived of as either what is brought to the market by the industrial group, or what is taken off the market by the group. The grand totals of these two measures of output are identical in all years. For a single industry this equality does not hold. What is brought to the market does not equal what the industry takes back: the deflated value of the iron ore produced by the mining industry does not equal the deflated value of the butter, eggs, automobiles, and machinery that workers, stockholders, and corporations in the mining industry buy. (They are equal to one another in the base year, however, if we assume that the entire income of the group is expended on purchases of commodities and services.) We must choose between these two deflated values and make our choice explicit. Since the second offers no special conceptual difficulties, we concern ourselves with the first.

A single industry is practically never completely responsible for the output of a given commodity or group of commodities. Even farming and mining only add value to certain materials, fuels, and services which they purchase from other industries. The physical output of a single industry is therefore merely a portion of the deflated value of the goods it brings to market. It is, in other words, the deflated value it has added—the deflated net value product.⁶ This deflated net value

⁴ The two concepts also suggest different statistical paths by which the aggregate may be obtained; but with this we are not concerned.

⁵ Cf. Simon Kuznets, "Income Originating in Nine Basic Industries," 1919-1934, *Bulletin 69* (National Bureau of Economic Research, 1936), p. 5, also A. F. Burns, *op cit*. An interpretation similar to that given here has been presented in a recent paper (as yet unpublished) prepared by M. A. Copeland and E. M. Martin for the Conference on Income and Wealth "The Correction of Wealth and Income Estimates for Price Changes."

⁶ Capital goods are also purchased from other industries. However, it is customary, and useful, to treat capital as a factor of production. It is for this reason, also, that capital goods are treated as "finished" goods.

The net value product defined in the text is gross by the amount of capital consumption.

product is not the same as the deflated value added as defined in the Census of Manufactures. The Census subtracts only materials and fuel.⁷ Payments to other industries for telephone service, typewriter ribbons, advertising, and machinery repairs are included in the Census "value added."

Just as the net value product of an industry is not measured by its gross income from sales, so is the deflated net value product not measured by the deflated gross value of product. In other words, an index of output based on the number of bags of cement produced by the cement industry is not an index of its deflated net value product. It would be so only if technical coefficients remained constant; i.e., if the quantity of rock, the amount of fuel, the number of telephone calls, etc., per bag of cement, remained constant; or if the changes in the technical coefficients happened to counterbalance one another. If economies have been effected in the use of fuel, these should be reflected in the deflated net value product.⁸

The only correct measure of the latter, then, is the deflated gross value of products minus the sum of the deflated cost of materials, fuel, etc., purchased from other industries. It is this measure which will be consistent with our identification of the total of finished goods and services with the sum of the products of single industries. If we were to ignore changes in technical coefficients the latter sum might exceed or fall short of the former.

In an industry in which increasingly successful effort is made to utilize by-products, an increase in output (as measured by deflated gross value of product) will be shown even if the quantity of materials used has remained constant. The true increase, however, will be understated by the deflated gross value; for, using the latter to measure the former implicitly assumes that the quantity of materials has increased in the same proportion as the total output.

It is not clear from the usual presentation of indexes of the physical volume of production whether they are supposed to represent the flow of goods and services gross or net with respect to capital consumption. This is another of the ambiguities surrounding most of these indexes. Probably, however, most constructors of indexes have in mind the

⁷ Contract payments are shown separately and may be deducted also, as they have been in the 1935 census

⁸ "Increased economy in fuel consumption in the modernized manufacturing plants, in central light and power stations, and in railroad locomotives has been particularly marked in recent years, largely on account of improved boiler construction, the adoption of mechanical stokers, the substitution of turbines for reciprocating engines, and the use of superheating equipment. Between 1919 and 1929 the consumption of coking coal per ton of pig iron decreased 11 per cent, the amount of coal consumed per kilowatt-hour of energy generated in central power stations declined 47 per cent, and the consumption of coal per thousand gross ton-miles by Class I railroads dropped about 24 per cent." (Fifteenth Census, *Manufactures, 1929*, Volume I, p. 160)

flow gross of capital consumption. For they think in terms of total output of apples, of dresses, and of machines, whether these are used to maintain capital or not. While both concepts are useful, we should specify the one being used. If the true net product is desired, it is necessary to subtract from the deflated value of products not only the deflated cost of materials but also the deflated depreciation and other charges for capital consumed.

The usual index of output (which is essentially an index based on deflated gross value of product) may sometimes be a fair approximation to an index of deflated net value of product. Changes in the technical coefficients relating to purchases of goods and services from other industries may in fact iron out; if not entirely, then at least in part.⁹ For most industries it is probably true that economies have been effected in the use of materials and fuels. On the other hand, deflated service charges have increased more rapidly than number of units of final product, as is probably true of expenditures such as on advertising. If these changes in technical coefficients can be explicitly introduced into the computation of the physical volume of output we should not trust to the possibility that they may cancel one another. We should go beyond a first approximation based on deflated gross value of product.

THE MILLS ADEQUACY RATIO

In few industries are all products reported by type and quantity. It is therefore necessary to estimate the physical output of those products for which the quantities are not reported. For this purpose we may distinguish between two groups of industries: (1) those that report quantities for a substantial portion of their output; and (2) those that do not. F. C. Mills has introduced the "adequacy ratio" for estimating the total output of industries in the first group.¹⁰ This is the ratio of the value, in a given year, of those products, for which quantities are reported both in the given year and in the base year, to the total value of product of the industry in the given year. Changes in this ratio are used to determine total output of those industries which report quantities for at least 60 per cent of their products (in terms of gross value).

Changes in the adequacy ratio indicate changes in the degree of coverage of the total value of output of an industry by the quantity data available. Three assumptions concerning the cause of this variation are possible.

⁹ In combining the movements of different technical coefficients, to get the net change, it is necessary to weight each technical coefficient properly. The appropriate weights are related to the ratio, in the base year, of the aggregate cost of each particular item to the aggregate value of products.

¹⁰ *Economic Tendencies in the United States* (National Bureau of Economic Research, 1932), p. 90

(1) It may be assumed that the prices of the goods not represented by physical quantity data have fluctuated in the same degree as the prices of the goods represented. It is then a simple matter to deflate the unrepresented portion of the value of product of the industry by an index of the prices of the represented portion. (The index is obtained by dividing the value relatives of the represented goods by the corresponding quantity indexes.) This is Dr. Mills' procedure.

(2) It may be assumed that the quantity of the unrepresented goods has fluctuated in the same degree as the quantity of the represented goods. This is the assumption made when changes in the adequacy ratio are ignored.

(3) It may be assumed that neither the quantity nor the price of the group of non-represented goods has followed exactly the movements of the quantity or price of the represented goods.

In the absence of specific knowledge, the first assumption is simplest and most practicable. It is justified by the belief that prices move together within closer limits than those within which quantities move together. However, if it is possible to obtain information concerning the non-represented goods, no assumption need be made. A suitable deflator, constructed specially for the purpose, can then be applied to the values of the non-represented goods. This will only sometimes be the same as the index corresponding to the prices of the represented goods.

This discussion is relevant not only to the measurement of the gross product of an industry, but also to the measurement of the physical volume of materials, fuel, etc., consumed by the industry and thereby to the measurement of the net product of the industry.

THE OUTPUT OF INDUSTRIES WHICH REPORT NO QUANTITY DATA

For many industries, even in manufacturing, data on quantities are few or entirely lacking. These industries may be treated in several ways.

(1) An index may be computed for a sample (say, of manufacturing industries) and, implicitly or explicitly, this index may be accepted as representing all industries in the group (i.e., in manufacturing).

(2) The index of output of a given industry (say, steel) may be accepted as measuring also the output of certain related industries (e.g., machinery) and the weights of the latter imputed to the index of the former. Difficulties arise, however, because of changes in technical coefficients, changes in the proportion of, say, steel going to different steel-using industries, imports and exports of semi-manufactured goods, and changes in inventories of semi-manufactured goods. These are seldom taken into account.

(3) The sample index may be "stepped-up" to the total by means of a ratio similar to the adequacy ratio. It may be assumed that prices in the non-represented industries have fluctuated exactly as have prices in the represented industries. Or the same assumption may be made concerning fluctuations in output per worker, or value added per worker.¹¹

(4) The value of product of the industries for which no quantities are available (or their cost of materials, assuming no changes in technical coefficients) may be deflated by the most suitable price indexes available. The deflators, at best, can only be crude, because (for logically best results) they should be computed as harmonic means with given year weights; this is impracticable because of the very lack of data which makes this roundabout method necessary.

It is curious that the most widely prevalent, and most inaccurate, method is the first. Less frequently used is the second. It is almost as illogical since in most cases it is applied without the corrections needed. The third has been applied in the construction of but one well-known index of output, that of F C Mills. The fourth has been used for one or two industries only. On a comprehensive scale, it has been applied by Simon Kuznets to the measurement of the output of finished goods.

OUTPUT OF THE SERVICE INDUSTRIES

The "service" industries offer additional difficulties which make it impossible, in practice, to avoid a cross of the concept of output of finished goods with that of industries. The contribution of some service industries to the production of physical commodities cannot be separated from the net contribution of the industries engaged primarily in turning out physical commodities—manufacturing, mining, etc. We must deal with the sum of these contributions, partly because of lack of data and partly because of the difficulty of determining what is the price or the physical unit of "service." For this reason it is impossible to measure the true deflated net product of single industries in manufacturing, etc. This means that the total output of the service industries must be broken down into two parts: (1) the output going to other business concerns, which is already included in the output of these concerns; and (2) the output going to ultimate consumers. That is, the latter quantity must be estimated. At best this can be done but roughly. But it is easier to estimate the latter quantity than to attempt to determine the "sales" by the service industries to each of the several other industrial groups.

The "service" industries include communication, professional services, services of government, finance, and real estate. Transportation

¹¹ The latter two are the assumptions made by F C Mills; see *Economic Tendencies*, pp 39-43

costs can be excluded from the value added in the physical-commodity industries because freight charges are considered part of the cost of materials. Real estate can also sometimes be excluded since rental payments are available by industries for certain years.

The output of the trade industries can be measured by an index such as that recently computed by Simon Kuznets.¹² This is simply the difference between the aggregate value (in 1929 prices) of goods passing out of trade and the aggregate value (in 1929 prices) of goods entering trade. Allowance is made, in this index, for changing proportions of goods handled at different gross-margin levels.

AGGREGATION OF THE OUTPUT OF SEVERAL INDUSTRIES

The concept of the output of a single industry above outlined implies a certain method of aggregation of the output of different industries. This formula is the relative of aggregates, with base year (or given year) "prices" as the constant factors. These prices are not selling prices: they represent net value added per unit of output in the base year. The prices that are usually used in combining output of individual industries are too great. Each may be too great in the same degree: the ratio of "value added" per unit, commonly used for manufacturing, to the net value product per unit in manufacturing (the correct "price") may equal the ratio of the gross value of minerals per unit of output, commonly used for mining, to the net value product per unit in mining. But this remains to be determined. We have, at least for recent years, sufficiently satisfactory estimates of the national product (the net value product gross by the amount of capital consumption) originating in specific industries so that these may be used as the basis for weights. Guesses or assumptions are unnecessary.¹³

When the output of the service industries cannot be separated from that of the physical-commodity producing industries, the weight of the indexes derived for the latter industries will be larger than the national product originating in them by the amount of the national product originating in the section of the service industries catering to them. This weight will more closely approximate "value added" as reported in the manufacturing Census, but it will still fall short of that amount.

The deflated net value products of single industries, properly computed and properly weighted as suggested above, will add up to the deflated total value of finished goods (including net changes in inventories and the difference between exports and imports).

¹² *Commodity Flow and Capital Formation* (National Bureau of Economic Research, 1938).

¹³ The national income produced in each of six industrial divisions has been used as weights for combining indexes of output of these divisions by W M Persons and Le B R Foster, "A New Index of Industrial Production and Trade," *Review of Economic Statistics* (Aug 15, 1933)

NOTES

SPECIAL MEETING OF THE AMERICAN STATISTICAL ASSOCIATION

A special meeting of the American Statistical Association was held in Ottawa, Canada, on June 28 and 29, 1938, in connection with the summer meeting of the American Association for the Advancement of Science. The meeting provided a unique opportunity for discussion of similarities and contrasts in the economic conditions and statistical work in the United States and Canada. Members of the Association from both countries participated not only in the scheduled program but in many informal discussions before and after the regular sessions. Members of the Association also attended the sessions of the section on social and economic sciences of the American Association for the Advancement of Science on the subject of "Science and the Future" and some of the sessions of other associations affiliated with the section.

PROGRAM OF THE OTTAWA MEETING

10 A M , TUESDAY, JUNE 28

ECONOMIC RELATIONS OF CANADA AND THE UNITED STATES

Chairman H D Scully, Dominion Commissioner of Customs

The Comparability of Some of the Principal Indexes of Economic Conditions in the United States and Canada

D C MacGregor, University of Toronto

Influence of the United States on the Course of Business in Canada

Walter Gardner, Board of Governors of the Federal Reserve System

1:30 P.M., TUESDAY, JUNE 28

THE BUSINESS OUTLOOK WITH SPECIAL REFERENCE TO GOVERNMENT SPENDING

Chairman H. A. Innis, University of Toronto

Leonard P Ayres, Vice-President, Cleveland Trust Company

Corrington Gill, Assistant Administrator, Works Progress Administration

Courtland Elliott, A. E. Ames and Company, Investment Brokers, Toronto, Canada

10:00 A.M., WEDNESDAY, June 29

RETAIL AND WHOLESALE TRADE

Chairman. Hon. Norman McL. Rogers, Minister of Labour, Canada

Some Aspects of Canadian Statistics of Merchandising and Service Establishments

H. Marshall, Chief, Internal Trade Branch, Dominion Bureau of Statistics

Some Comparisons of Canadian and United States Distribution Patterns

Vergil Reed, Assistant Director, U. S. Bureau of the Census

(With a discussion by both speakers of problems and plans for future distribution censuses)

The Effects of Credit and Inventories on the Flow of Goods

Willard Thorp, Director of Research, Dun and Bradstreet, Inc.

2:00 P. M., WEDNESDAY, JUNE 29

WEATHER AND CROP YIELDS

(Joint session with the Canadian Agricultural Economics Society and the Canadian Society of Technical Agriculturalists)

Chairman: T. W. Grindley, Chief Agricultural Statistics Branch, Dominion Bureau of Statistics

Crop-Weather Research in the United States

C. F. Sarle, Bureau of Agricultural Economics

Fall Precipitation and Wheat Yields in Western Kansas

George Montgomery, Kansas State College

Relations Between Weather Factors and Wheat Yields in Western Canada

C. F. Wilson, Dominion Bureau of Statistics

Discussion: J. W. Hopkins, National Research Council, Canada

The Ottawa meeting was the second in a series of special meetings of the Association which are held each summer in cities to which the annual meetings are seldom taken. The first meeting in this series was held in Denver in June 1937.

FREDERICK F. STEPHAN, *Secretary*

THE WISCONSIN COMMITTEE ON STATISTICS

With the growth of statistical work in the various departments of the Wisconsin State Government, the Executive Council was impressed with the problems arising out of possible overlapping of the various activities and the lack of coordination in such efforts and in the reporting forms of the different departments. In February, 1938, the Council appointed a special committee, consisting of the statisticians of the various departments of the state government with E. W. Morehouse of the Public Service Commission as chairman, for the purpose of studying the problems of coordinating within the state government the various efforts in this growing field.¹

In its early meetings the committee discussed various approaches to the problems with which it was to deal, and early in March a report to the State Executive Council stressed the following points:

1. *Organization of Statistical Divisions* It was the view of the committee that the gathering and assimilating of the statistical information by the various state agencies will be most effectively performed by maintaining the statistical divisions within each of the several state departments as autonomous units, directly responsible to the department heads

2. *Coordination of Statistics* Because of the growing use of statistical data by officials and by the general public, there is an increasing need for coordination in the field. To serve this need, an exchange of information between the statistical workers of the various departments, especially on new undertakings, will tend to eliminate duplication, perhaps eliminate some overlapping, and also make studies more comparable or facilitate joint enterprises

3. *Reporting Forms.* Ways and means need to be found of simplifying and unifying reporting forms so as to reduce the burden of reports required or requested from individuals and organizations furnishing data to the various state and federal agencies. Duplication and overlapping of material required in reports of different governmental units should be reduced to the lowest point possible.

4. *Improvement in State Statistics.* This would include the study of problems relating to such matters as personnel, mechanical tabulation, preparation of publications and presentation, the review of work already done, and an advisory appraisal of proposed new projects.

5. *Index of State Statistical Information.* A need exists for an index of statistical information covering data gathered by the state or pertinent to the state which could be available to all departments and the public. It was proposed that this index include a description of definitions, methods, and coverage of existing series. Such an index might help to avoid duplication

¹ The members of the committee are: E. W. Morehouse, Chairman, Sidney Lerner, Secretary; C. A. Bontly, Wisconsin Conservation Commission; Walter H. Ebling, Department of Agriculture and Markets; O. A. Fried, Industrial Commission; James Hanks, Department of Commerce; Frank Hanna, Tax Commission; Arthur Jacobs, Public Welfare; Harry Jerome, University of Wisconsin; Francis E. Kester, Board of Health; L. B. Krueger, Tax Commission; Hazel K. Merriman, Banking Commission; B. O. Odegard, Board of Control; and B. J. Sickler, Public Service Commission

and overlapping of work and be the basis of decisions regarding new work, particularly in closing gaps in existing statistical data. In addition, it would furnish a source of statistical information for the public so as to relieve the departments of the growing burden of answering current inquiries for statistical data. The committee recommended that the State Legislative Reference Library designate a research associate to devote time to this work.

Obviously, the various state statistical problems, which the committee recognized early as needing study, could not be adequately gone over in the short time during which this body has been functioning. While progress has been made toward some of the objectives, the committee itself will act mostly in an advisory capacity and will make recommendations to the Executive Council with which will rest the final decision in matters where several departments are concerned. Specific problems have been assigned to smaller committees, some of which have made reports that became the basis of recommendations to the Executive Council. Among the items already reviewed by sub-committees have been such matters as the proposed index of statistical information, mechanical tabulation, reporting forms, publication problems, and personnel. Preliminary reports have been made to the Executive Council on mechanical tabulation, reporting forms, and publication problems.

Sidney Lerner has been designated as a full-time secretary of the committee and he will also head up such research projects as the committee finds necessary to carry on. The compilation of a state statistical index is in progress and will be developed as a unit of the State Legislative Reference Library so that it may serve the various state departments and the public as well. While this work is only in its beginning, state departments have already been asked to supply lists and descriptions of their statistical series so that a start can be made in centralizing these data.

A sub-committee is working on the problem of machine tabulation and tabulating equipment. A survey has been made of the equipment available in the different departments, and a procedure has been suggested for inter-departmental use of existing state facilities. The matter of the possible establishment of a central machine tabulating unit has also been discussed.

The matter of unifying and simplifying reporting forms was undoubtedly one of the problems which was basic in the establishing of the state statistical committee. Several committee members have worked on this problem, which has been found to be extremely complex. One report has been made by this sub-committee which will result in reorganizing the work of one state department. A further project now contemplates the consolidation of reporting forms and auditing activities of three departments.

A sub-committee reviewed the problems in statistical publications and some specific recommendations looking toward reduction in cost and more effective publication of important statistical series have been made to the Executive Council. A beginning has been made in studying the problem of personnel for statistical work in the various state departments, and while some data have been collected no report has yet been made on this subject.

An important phase in the early work of this committee has been the opportunity for the members to become acquainted with the statistical problems of the various departments. Those in charge of departmental statistical work have given brief formal reviews of their fields and submitted copies of publications, schedules, etc., concerning the work in their respective departments. The broader understanding which is possible as a result of having a fuller knowledge of the statistical functions of the different departments is very helpful in facilitating the work of the committee as well as that of the members themselves. Only by knowing what is going on in the different units can the group function properly as a clearing house for problems and ideas in the state statistical set-up. Clearly the statistical data of the state will be improved when the statisticians who compile them see their significance more nearly from the viewpoint of the state government as a whole than in the light of one department's needs.

WALTER H. EBLING

Wisconsin Department of Agriculture and Markets
and U S Bureau of Agricultural Economics

CONFERENCE ON EMPLOYMENT AND PAYROLL STATISTICS

Sixteen state offices which cooperate with the U S. Bureau of Labor Statistics in the collection and tabulation of employment and payroll statistics were represented at a three-day conference sponsored by the Bureau, June 20-22, 1938.¹ The meetings, held in the Department of Labor Building in Washington, were devoted to discussions of techniques and procedures in the field of employment statistics.

Similar conferences were held in June of 1937 and in June, 1936, the year which marked the expansion of the Bureau's cooperative arrangements with state agencies from collection only to cover also the joint editing and

¹ Those in attendance were Arkansas—G B Segraves, Statistician, Bureau of Labor Statistics, California—Thomas F Corcoran, B L S representative with the Division of Statistics and Law Enforcement, Department of Industrial Relations, Illinois—Esther Espenshade, Division of Statistics and Research, Department of Labor, and R S Barker, B L S representative, Indiana—C F Davis, Statistician, and C F Gross, Supervising Clerk, State Employment Service, Kansas—Nellie Kennedy, Office of Labor Commissioner, and Crystal Wheeler, B L S representative, Maryland—Madeleine V Dunne, Statistician, Office of Commissioner of Labor, and Mary Warren, B L S representative, Massachusetts—Roswell F Phelps, Director, Division of Statistics, Department of Labor and Industries, and Harry B Sheftel, B L S representative, Michigan—M S Cone, Statistician, Department of Labor and Industry, Minnesota—Erwin A Gaumnitz, Director, Bureau of Research and Information, Division of Unemployment Compensation, Department of Labor and Industry, and Irene Greene, B L S representative, New Jersey—Abe Rothman, B L S representative with Bureau of Statistics and Records, Department of Labor, New York—Mildred A Lauder, Statistician, and Elizabeth Corr, Division of Statistics and Information, Department of Labor, North Carolina—Pauline W Horton, Chief, Division of Statistics, and Margaret Hillen, B L S, representative, Pennsylvania—Helen M Conne, Department of Research and Statistics, Federal Reserve Bank of Philadelphia, LeRoy Fox, John L Martin and Hugh S Duffey, Bureau of Research and Information, Division of Labor and Industry, and Erma W McKinney, B L S representative, Texas—F A Buechel, Assistant Director, Bureau of Business Research, University of Texas, and Alton P Vickery, B L S representative; Wisconsin—Orrin A Fried, Statistician, Industrial Commission, and G A Rothfuss, B L S representative

tabulating of the data. As early as 1922 a number of states which had pioneered in the collection of employment statistics entered into agreements with the U S Bureau of Labor Statistics whereby the federal Bureau furnished the postal frank for the mailing and collecting of the schedules by the states. Either the original schedules or transcripts of the data were then sent to Washington from the state office. Both state and federal tabulations were prepared from the same set of schedules, and employers were relieved of duplicate requests from two agencies.

Until 1936, however, the national and state figures were processed independently by the B. L. S. and each of the state offices. There had been but little effort toward uniformity in editing procedures, industrial classification, tabulating processes, and final presentation of the data. In May, 1936, arrangements were entered into whereby the B. L. S. furnished additional help to the state offices, usually in the form of clerical assistance, according to the needs of the state and volume of reports handled. In return, the states agreed to furnish to the Washington office, on specified dates, tabulations for inclusion in the national totals of the B. L. S. The contracts covering the arrangements specify the form of the tabulations, the editing procedures and industrial classification to be followed, the status of the federal employees in the state offices, etc.

The states represented in the cooperative set-up are, for the most part, those in which manufacturing activity is concentrated, as attested by the fact that they accounted for over two-thirds of manufacturing whether measured by establishments or employees. Nearly 70 per cent of the Bureau's manufacturing sample is included in reports received through the state offices. For nonmanufacturing industries the percentage of reports handled by the cooperating states varies, but in most cases it is above 50 per cent.

Since the inauguration of the joint tabulating procedures, the Bureau has been in constant touch with the state offices through correspondence and through visits by its staff members. In addition, it has been found profitable to the work to hold the periodic conferences of state statisticians, affording an opportunity for round table discussions of the problems which arise in connection with the work, bringing forth contributions based on the experience in each office, and for personal contact between the statisticians from the states and the B. L. S.

The recent June conference was opened by addresses by the Commissioner of Labor Statistics, Mr. Isador Lubin, on "The Wages and Hours Act—Its Statistical Implications;" by the Chief Statistician of the Bureau, Mr. Sidney W. Wilcox, on "The Uses of Employment and Payroll Statistics;" and by Miss Aryness Joy, Assistant to the Commissioner, on "The Relation of Current Employment Statistics to Social Security Reports."

There were some fifty items on the agenda. The discussion on topics of more general interest is summarized below.

The Sample. In the discussion of what constitutes an adequate sample it was pointed out that the B. L. S. strives for a coverage of at least 50 per

cent. Of the 89 manufacturing industries covered, six have a representation of over 90 per cent, 12 over 80 per cent, and in only 13 is the coverage less than 45 per cent. In industries characterized by many small establishments, such as clothing and retail food stores, it is not practicable to attempt to cover a high proportion of the total number of establishments, and the importance of weighting the sample to give these industries due influence was stressed. Weighting for large and small firms was recognized as sound procedure within those industries where establishments of varying size are found, to counteract the tendency for a few large plants to dominate the sample for those industries. State and Bureau representatives contributed to a discussion of how to build up mailing lists, second requests and other follow-up procedures, the value of personal contact with employers, effective form letters, bringing newly established companies into the reporting set-up, etc. The problem of establishing and maintaining an adequate sample for building construction received particular attention.

Adjustment to Census The method used by the Bureau for adjusting indexes of employment and payrolls to conform to the biennial Census of Manufactures and other periodic censuses of nonmanufacturing industries was set forth in detail and mimeographed instructions were distributed. Several states are adjusting their indexes to the Census and a number of others expressed interest.

Industrial Classification. It was recognized that uniformity between state and B. L. S. classification of industries is desirable, both because it facilitates comparison between local and national changes and trends, and because it eliminates duplication of work in preparing the tabulations for the state and the B. L. S. It was admitted that some industries are important to a state report which would not be sufficiently significant to be shown separately in the national summaries, on the other hand, there are industries which are of importance in the national picture which would not appear in some states. In making adjustments in the classification for such cases, it should be possible to preserve the basic comparable arrangement.

The work of the Central Statistical Board's committee on a standard industrial classification was explained. Copies of the preliminary report for manufacturing industries were distributed. The Census of Manufacturers will probably shift to this standard classification in 1939, and the B. L. S., which bases its classification on that of the Census, will then adopt it also. The state officers were urged to consider the adoption of the standard classification as far as practicable.

Conversion factors for reducing reports to a weekly basis. The employment and payroll questionnaires call for reports "for the pay period (preferably one week) ending nearest the 15th of the month," but many firms use longer pay periods—two weeks, a half month, or a month, and report on that basis. It is necessary that all schedules be edited to an equivalent weekly figure and the problem was discussed of revising the conversion factors. This matter is to be the subject of a special memorandum.

Individual establishment reports to B. L. S. During the course of the con-

ference, arrangements were made with each state whereby the individual plant reports will be furnished each month to the B. L. S. by one of two principal procedures. Offices with machine tabulating equipment will send duplicate punched cards; others will loan their office record cards temporarily. It has been found necessary to maintain these records in the Washington office as well as in the states in order to meet special requests for information tabulated by regions, by size of plant, for a portion of one of the B. L. S. standard industry classifications, etc.

Weighted indexes for states and cities. The B. L. S. national industry averages are weighted and some of the states publish weighted indexes. The conference recognized the importance of setting up weighted indexes for states and cities. It was generally agreed that the state offices should undertake the work wherever possible.

The treatment of bonuses, vacations with pay, etc. The question of how to handle in the payroll figures items such as special bonuses, commissions, vacations with pay, vacations not taken but paid for, etc. had been particularly perplexing. The payment of bonuses to wage earners has been a growing practice. Including such irregularly occurring payments would result in marked fluctuations in average hourly and weekly earnings while wage rates actually remained constant, excluding them, on the other hand, fails to give a true picture of labor income.

It was agreed that commissions paid more or less regularly each month should be included in the payroll figures, for some types of employees commissions constitute the major portion of their pay. Bonuses, on the other hand, are not to be included unless they are paid regularly, as in the case of some production bonuses. When bonus payments are made annually, the information will be requested on a special questionnaire, these lump payments can then be taken into account for determining annual income, national income, etc. and yet not be allowed to distort the payroll index and average weekly earnings figure for any one month. Vacation pay, likewise, will be requested as a separate item, it can be added to the regular payroll figure if desired, but excluded from computations of average hourly earnings.

On the matter of perquisites and other noncash payments, representatives of the B. L. S. and the Social Security Board had conferred previous to the conference. Their recommendation, accepted by the state statisticians, was that although the Social Security Board requires perquisites to be included in payroll figures, the reports are not sufficiently comprehensive or reliable to warrant a change from the present B. L. S. policy of securing reports for cash payments only.

Recent special studies. (1) Employment and earnings reported by sex. In September, 1937 a semi-annual survey was instituted whereby the B. L. S. and cooperating states request a classification of employment, payroll, and man-hours data by sex in important woman-employing states and industries. The Women's Bureau edited and tabulated the reports. Results of the September 1937 and March 1938 surveys are available from the Women's Bureau of the Department of Labor.

(2) Office employment and payrolls. The B. L. S. has tabulated data on employment and earnings of office employees in manufacturing industries for January, June, and December of 1935 and June and December of 1936 and 1937. This information is no longer requested on the monthly questionnaire, but is secured, with the cooperation of the state offices, on a special schedule for June and December. (Some states continue to collect the data monthly for their own use.)

(3) Length of pay period. Plans were made for a special tabulation of the length of pay periods (one week, two weeks, half-month, month, etc.) in firms reporting employment. The new study applies to the month of August, 1938, and will bring to date similar studies made by the Bureau in 1929 and 1935.

(4) Full-time and part-time employment in retail trade. The schedules used by the B. L. S. and the majority of states do not request separate reports for full-time and part-time employees. As a consequence the reports including all types of employees show lower average earnings and average hours than is characteristic of normal full-time employment. New York is one state which has collected the data separately for part-time workers in retail trade. The B. L. S. has borrowed the New York schedules and made a trial tabulation which indicated significant differences between the hours and pay of the full-time and part-time employees. Consideration will be given to securing regular nation-wide reports on this basis for retail trade.

Loan copies of the minutes or information on other agenda topics can be secured upon request to S. W. Wilcox, Chief Statistician, Bureau of Labor Statistics, Department of Labor, Washington, D. C.

ERNESTINE WILKE

Bureau of Labor Statistics

CURRENT DOMESTIC TRADE STATISTICS

Additional expansion has recently taken place in the Current Statistical work of the Bureau of Foreign and Domestic Commerce. This expansion is primarily in the fields of wholesale and retail trade, and is a continuation of a program initiated in 1933 which was designed to measure the movement of the flow of goods from the producer to the consumer. The paucity of such data had long been realized both by those actively engaged in business and by students.

Retail Trade.—The Bureau's initial studies of domestic trade were in the chain store and mail order fields. Indexes were constructed for dollar sales of limited price variety chain stores, grocery chain stores, dollar volume of new passenger automobiles and rural retail sales of general merchandise. The series were prepared on a 1929–1931 base and are available by months since January 1929 both with and without adjustment for seasonal variations. The methods employed in the construction of the individual indexes have been described in various issues of the *Survey of Current Business*.¹

¹ Description of the indexes can be found in the March, April and May 1934 and the May 1937 issues of the *Survey of Current Business*, Bureau of Foreign and Domestic Commerce, Washington, D. C.

These series, together with the Department Store Index of the Board of Governors of the Federal Reserve System, have a coverage of about one-fifth of total retail sales. Nevertheless, there exist many wide gaps in our information as well as the need of regional and local data. Consequently, a program designed to fill in these gaps was put into operation in the fall of 1935. This retail program envisaged the collection of independent store sales by states, by cities, and by kinds of business, and the collection of additional chain store data upon a regional basis with the ultimate objective of preparing and publishing a reliable monthly index of total retail sales.

The independent store series presented a major problem, owing to the magnitude of the task in securing a representative sample, both geographically and by kinds of business, from some 1,500,000 independent retail establishments. It was decided that data should be collected on a state basis and since the fall of 1935, when the first releases were issued, the program has been gradually developed until approximately 20,000 reports are being received each month from the 28 states covered. These states account for approximately 60 per cent of total independent store sales, and at least one state in each of the nine geographical regions as defined by the census is represented. The list of states by regions which are being covered at present is as follows:

<i>New England:</i>	<i>South Atlantic:</i>	<i>Mountain:</i>	<i>Pacific:</i>
Massachusetts	Florida	Arizona	California
	Georgia	Colorado	Oregon
<i>Middle Atlantic:</i>	South Carolina	Idaho	Washington
Pennsylvania		Montana	
	<i>East South</i>	Nevada	
<i>East North</i>	<i>Central:</i>	New Mexico	
<i>Central:</i>	Alabama	Utah	
Iowa		Wyoming	
Kansas	<i>West South</i>		
Missouri	<i>Central:</i>		
Nebraska	Arkansas		
	Oklahoma		
	Texas		

Detailed releases are also issued for the cities of St. Louis, Chicago, Los Angeles and San Francisco. Each monthly release presents by kinds of business the percentage change from both the previous month and from the corresponding month a year ago. An aggregate of dollar sales reported is also published permitting an evaluation of the samples. In the state releases similar changes are shown by city-size groups and in those instances where a well diversified sample is available, total changes are recorded for individual cities.

The collection and tabulation of the independent store data further serve as additional basic material from which a monthly comparison of trade by kinds of business and by states can be determined. These data indicate the

variation in seasonal movement and will eventually serve as a base for the calculation of seasonal variations and the making of time series analyses.

Supplementary reports upon chain store activity which have been undertaken since October 1935 cover the drug and men's wear fields with preliminary work completed for women's wear and shoe chains. With these additions a coverage of over 50 per cent of the total chain store sales is represented and provides the basic data for the preparation of a monthly index of sales through this type of institution. Both the drug and men's wear series are shown on a regional basis with the drug series further providing comparative data for sales in tobacco and fountain departments. The men's wear information is shown not only by departments such as suits, hats, top-coats, but also by price ranges.

Since January 1938 monthly data on the cost value of stocks on hand, both in retail stores and warehouses, have been collected from chain retailers in the variety, grocery and general merchandise fields. The first public release of these stock data was recently presented together with a midyear summary of retail trade.

The Bureau's future program includes the extension of the current reporting service for independent stores into all states as well as the collection of data from other retail sources. It is also planned to collect current data on credit sales, accounts outstanding and collections made.

All of this basic material, together with that from various sources, is used in preparing the Bureau's annual estimates of total retail trade.

Wholesale Trade—The monthly collection, analysis, and dissemination of current data reflecting conditions in wholesale trade was initiated by the Bureau in cooperation with the National Association of Credit Men. Arrangements were made with the various Federal Reserve Banks, which were collecting similar information, so that duplication would be avoided and all information of this nature eventually would be collected by the Bureau of Foreign and Domestic Commerce. The first release, which covered data for January 1936, was based upon reports from nearly 600 wholesalers who furnished comparative sales figures and data for the ratio of collections to accounts receivable outstanding. A like number of manufacturers contributed similar information. By June of 1938 the number of wholesalers contributing data had increased to 2,200, with sales for that month aggregating \$179,000,000. The number of manufacturers contributing data had increased to over 1,100 with a sales volume of \$198,000,000.

During 1937 intensive promotional work in wholesale trade for Electrical Goods, Drug, and Hardware resulted in greatly increased samples and the addition of information on inventories to that already being collected on sales and credit. Special trade reports presenting adequate and valid summaries in these fields were then initiated. These special summaries also include information on manufacturers and, in the Drug and Hardware bulletins, figures on retail trade are shown. Thus, in a single publication there is reviewed the current condition of a complete industry, from manufacturer through the wholesale and retail distributive channels to the ultimate con-

sumer. During the early part of this year a special monthly bulletin covering the food industry was added.

Toward the close of 1937 the increasing magnitude of the business recession resulted in a mounting interest in more adequate information with regard to inventories and their relation to sales. One of the focal points of interest in this respect was the situation in the various wholesale trades. As a result of this keen desire manifested by many business men to be better informed as to the movement of goods, the regular monthly bulletin covering all lines of wholesale trade was expanded to include inventory information by lines of business and by regions. These data were first published in the December 1937 report. With about 1,300 firms reporting their monthly inventories in the June survey, an important beginning has been made in supplying answers to the many questions on this subject which business men have been asking for years. Not only does the wholesaler have some indication of his own stock situation as compared with the average for his own trade and geographical region, but the manufacturer finds the data of extreme usefulness in preparing and carrying out his sales and marketing programs.

As of January 1, 1938, the Federal Reserve Banks transferred to this Bureau their activities in connection with wholesale trade reporting. In order that those who have been using data upon a Federal Reserve Regional basis can continue to secure it, the Bureau of Foreign and Domestic Commerce prepares a monthly tabulation for all but one of the 12 banks to be included in the bulletins of the Federal Reserve Banks. The future work of the Bureau in reference to wholesale trade will be confined to the improvement of the sample of reporting firms, to the analysis of data collected and the construction of indexes by kinds of business, together with the preparation of estimates of total wholesale trade.

EDWARD L. LLOYD

Bureau of Foreign and Domestic Commerce
U. S. Department of Commerce

THE ANNALS OF MATHEMATICAL STATISTICS

At the time of the organization of the Institute of Mathematical Statistics in 1935, the *Annals of Mathematical Statistics* was adopted as the official journal of the Institute. However, the financial responsibility for the *Annals* was not undertaken by the Institute until this year. Final arrangements were made last April for the Institute to assume complete responsibility for the publication of the *Annals*. With the June issue of the current volume, the Institute has arranged for the *Annals* to be edited by Professors S. S. Wilks of Princeton University, A. T. Craig of the State University of Iowa, and J. Neyman of the University of California, with the cooperation of the following advisory editors: Professor H. C. Carver, University of Michigan; Professor H. Cramér, University of Stockholm,*Sweden; Dr. W. E. Deming, U. S. Department of Agriculture; Professor G. Darmon,

University of Paris, France; Professor R. A. Fisher, University College, London; Dr. T. C. Fry, Bell Telephone Laboratories; Professor Harold Hotelling, Columbia University; Professor R. de Mises, University of Istanbul, Turkey; Professor E. S. Pearson, University College, London; Professor H. L. Rietz, State University of Iowa; and Dr. W. A. Shewhart, Bell Telephone Laboratories.

The *Annals* will continue to be devoted largely to original research papers dealing with topics in the mathematical theory of statistics, together with such examples as may be useful in illustrating or experimentally verifying the theory. However, in view of the purpose of the Institute of Mathematical Statistics which, interpreted broadly, is to stimulate research in the mathematical theory of statistics and to promote cooperation between the field of pure research and fields of application, plans are being made to extend the scope of the *Annals* to include expository articles from time to time on various fundamental notions, principles, and techniques in statistics. Recognizing that many theoretical statistical problems have their origin in various fields of pure and applied science and technology, papers and shorter notes dealing with theoretical aspects of statistical problems arising in such fields will be welcomed by the editors

The editorial committee has been selected with the foregoing editorial policy in view. Furthermore, realizing the prime importance of European contributions to statistical theory, the Institute has decided to actively encourage European contributions to the *Annals* by inviting several eminent European mathematical statisticians to serve on the editorial committee.

The *Annals* will continue to be published quarterly in March, June, September, and December. The subscription rate will remain at four dollars per year.

The *Annals of Mathematical Statistics* was established by Professor H. C. Carver, of the University of Michigan, in 1930 with the sponsorship of the American Statistical Association. During its first year it was underwritten by Mr J. W. Edwards of Ann Arbor, Michigan, and during 1931, 1932, and 1933 it was underwritten by the American Statistical Association as a regular publication of the Association. From 1933 until this year the financial responsibility of the *Annals* was borne by Professor Carver himself. His success in establishing and continuing the *Annals* in difficult times is a remarkable accomplishment which is extremely fortunate for the Institute. It is hoped that Professor Carver's work will find its fruition in the growth of the *Annals* under the new arrangement.

JOURNAL OF THE POLISH STATISTICAL SOCIETY

The Polish Statistical Society has just published the first number of the *Statistical Review, Journal of the Polish Statistical Society*, devoted to the theory and practice of statistics. The editorial board includes Zygmunt Limanowski, Chairman; Stefan Szule, Deputy-Chairman; Jan Wiśniewski, Secretary; Antoni Łomnicki, and Jan Piekalkiewicz. While most of the

papers are published in Polish, it is the policy of the *Statistical Review* to include papers in English, French, German, or Italian. To each paper an English summary is appended. The first issue includes the following articles, all in Polish: M. Przytkowski, The Census of Agriculture; E. Szturm de Sztrem, The Problem of Classification in Statistics; J. Czekanowski, A Contribution to the Synthesis of Cartograms; J. Wiśniewski, Remarks on the Definition of an Average; S. Szulc, The Influence of Age at Marriage on Fertility and Nativity; B. Biegeleisen, The Application of Statistical Methods in Psychology; E. Vielrose, Mortality of Eminent Persons during the Period 1000-1799. Reviews, proceedings of the Society and its sections and branches, and other notes are also included. The *Statistical Review* is published quarterly. The subscription price is zł 15 per annum.

A MANUAL OF DESIGN AND CONSTRUCTION OF TIME-SERIES CHARTS

The Sectional Committee on Standards for Graphic Presentation, sponsored by the American Society of Mechanical Engineers under the procedure of the American Standards Association, has prepared a proposed American standard for time-series charts. This manual is a rather comprehensive revision of the earlier draft issued in April 1936 under the title, "Code of Preferred Practice for Graphic Presentation—Time-Series Charts." Many of the principles of graphic presentation which are formulated in the manual for time-series charts are applicable to other types of charts. A. H. Richardson of the Bell Telephone System is Chairman of the Subcommittee which prepared the manual and is the representative of the American Statistical Association on the Sectional Committee. The manual is being published by the American Society of Mechanical Engineers, 29 West 39th Street, New York City, at a price of \$1 00.

A CORRECTION

In the article by H. Muench on "Discrete Frequency Distributions Arising from Mixtures of Several Single Probability Values" which appeared in this JOURNAL 33 (1938), 390, a correction should be made on page 392. The third line of equation (7a) should read:

$$k = a^{r+1}/r! \text{ where } \Sigma y \text{ is put equal to 1 and } r! = \Gamma(r+1)$$

STATISTICAL NEWS AND NOTES

Central Statistical Board

The President, by a letter dated May 16, 1938, has requested the Central Statistical Board to report to him not later than January 1, 1939, on the burdens and duplications involved in statistical work carried on by the Federal Government, with particular reference to the numbers of financial and other statistical reports and returns regularly required from business and industry and from private individuals under existing laws.

The Board has appointed a special committee to direct the work on the report. The membership of the committee includes the Chairman of the Board, Stuart A. Rice, as Chairman, Messrs. E. E. Day, President of Cornell University; E. Dana Durand, U. S. Tariff Commissioner; E. A. Goldenweiser, Director of the Division of Research and Statistics of the Board of Governors of the Federal Reserve System; and Morris A. Copeland, Executive Secretary of the Central Statistical Board. Mr. Frederick F. Stephan, Secretary-Treasurer of the American Statistical Association, has been chosen Secretary of the Committee.

The staff of the Central Statistical Board is now engaged in a series of investigations which are directed to securing data which the Special Committee feels that it will need in meeting the President's request for constructive suggestions looking toward a reduction of the number of financial and other statistical reports and returns without handicapping either the Government or business users of information collected by the Government.

Letters have been addressed to the heads of Federal agencies, outlining the Board's needs, and informal conferences have been held to explain the program in more detail and to make arrangements for the submittal to the Board of complete sets of questionnaires and return and report forms used during the last fiscal year, certain descriptive materials about them, and copies of the statutory authorizations, executive orders, regulations and departmental or other orders upon which each is based. Much of the information required has already been collected by the Board in connection with its regular work program, but a comprehensive re-review of all current statistical work has been decided upon in order to supplement and complete the materials available in the Board's files.

Members of the Board's staff have supplied copies of special forms for the listing and cataloging of all questionnaires and other report forms sponsored by each agency. The first of the forms consists of a general check list on which the name of each questionnaire or other report or return will be entered. This list will be keyed by the agencies to individual copies of a second form which will be used as an identification sheet upon which will be entered a description of each form, together with such other remarks as the agency deems pertinent to the special problems which may have arisen in the use of the form. The check list and the identification sheets are being analyzed by the Board's staff and tabulations will be made of the data for use in preparing the final report.

The Technical Committee for Manufacturing Industries has completed its work for the interagency Committee on Industrial Classification (see this JOURNAL, 33 (1938), 235) on a preliminary classification of manufacturing industries. Volume I, Part 1, of the Standard Industrial Classification Code, containing code numbers and titles of manufacturing industries, has been multigraphed and is available for distribution upon request. The Technical Committee has also completed its work of preparing a description of industries and lists of principal products and principal operations. The list of principal products and operations will be presented as a general index for manufacturing industries

Dominion Bureau of Statistics, Canada

Social Analysis The Dominion Bureau of Statistics has recently inaugurated a seminar for the purpose of discussing specific problems arising in the course of the work of the various Branches. The persons most concerned prepare and read before the group papers describing specific problems they have encountered and their methods of approach in overcoming them. The ensuing discussions are productive of many helpful suggestions and so far the seminar has proved most successful.

Education. During the week of May 23rd, several national organizations in the field of the social sciences met in Ottawa, and representatives of these, together with Dominion Government officials, met to discuss means of improving and facilitating Canadian research in this field. Two meetings were held, at the first of which the Dominion Statistician addressed the group on the relation of statistics to the social sciences. A discussion followed on the possibility of establishing a committee on social research to which the organizations taking part were asked to name representatives. These organizations were: the Canadian Historical Association, the Royal Society of Canada (Section 2), the Canadian Political Science Association, the Canadian Institute of International Affairs, the Canadian Committee of International Geographical Union, and the Canadian Agricultural Economics Society. The Canadian Psychological Association and the Canadian Education Association were also invited to participate but acceptance has not yet been received. The Chairman of the Committee is Professor Reginald G. Trotter of Queen's University.

External Trade. The primary compilation of trade statistics, formerly carried out by the Department of National Revenue, has been transferred from that Department to the Dominion Bureau of Statistics. In the past the Dominion Bureau of Statistics has had to depend on the Department of National Revenue for the primary data, but in the future will be responsible for the compilation and publication of all trade statistics from their source.

Division of Research and Statistics, U. S. Treasury Department

The Treasury Department is preparing for publication a statistical report containing data compiled from income tax returns, under an allotment from

funds made available to the Works Progress Administration for research projects. The report consists of statistical tables prepared from income tax returns for 1934 of individuals, partnerships, and fiduciaries, and provides information supplementary to that regularly included in the annually published report "Statistics of Income." The project was supervised by the Director of Research and Statistics for the Treasury Department, with the cooperation of the Central Statistical Board and consulting experts from other agencies, and of the Works Progress Administration.

The first section of the report, entitled "Statistics of Income Supplement, compiled from Federal income tax returns of individuals for the income year 1934, Section I," showing number of individual income tax returns for 1934 classified by counties, and cities of 25,000 and over population, by net income classes, was issued during July. In this report the number of returns, Form 1040, designed for individuals with net incomes from salaries or wages of more than \$5,000 and incomes from business, professions, rents or sale of property, is shown separately from the number of returns, Form 1040-A, designed for individuals with net incomes of not more than \$5,000 derived chiefly from salaries and wages. This publication may be secured from the Superintendent of Documents for a nominal charge. Additional sections of the report will be issued as completed.

In addition to the report which will be published, a detailed set of tables of corporate and individual financial information reported on income tax returns has been compiled. These tables are supplemental to "Statistics of Income" for the years 1926-1933, inclusive, as one part of the project carried on with funds from the Works Progress Administration. Similar tabulations for 1934 and 1935 are in preparation by the Bureau of Internal Revenue, and it is planned that those for subsequent years will be made as rapidly as possible after the data become available.

This Source Book of detailed tables is primarily a transcription for each year from 1926 through 1933 of the work sheets of corporate and individual income tax tabulations and will be available to qualified students. Application to inspect the Source Book should be addressed to the Secretary of the Treasury.

The additional data provided for each year by the Source Book are described below in terms of the tables published in "Statistics of Income for 1933."

The receipt, deduction, and tax items of all corporations (see stub of Table 13) are shown for each of 91 industrial groups in each of the 51 States and Territories for each year from 1926 through 1934. The asset and liability items listed in Table 15 are shown for each year from 1926 through 1929 for each of the 21 major industrial groups, returns with net income and returns with no net income being shown separately. For 1930 this table is shown in summary form for each of the 91 industrial groups, and for 1931 through 1933 it is shown for each of the 91 industrial groups in each State and Territory.

Selected items of assets, liabilities, receipts, deductions, and tax (the

items in the stub of Table 16) are shown by the 21 major industrial groups and 9 size groups (size being measured by total assets) for each year from 1931 through 1933. Corporate returns for each year from 1926 through 1933 are shown by size of net income and deficit classes varying in number according to years, and by 21 major industrial groups, giving the number of returns, net income or deficit, and tax. A special table of consolidated returns shows the items of assets, liabilities, receipts, deductions, and tax listed in Table 16, for 91 industrial groups for 1933.

The most valuable table based on the individual returns shows for each year from 1927 through 1933, for each net income class, by States, data on sources of income and deductions (as in stub of Table 6 of the 1933 volume). A second table shows for each State data on the number of returns and amount of net income classified by size of net income and cross-classified by sex and family relationship (i e., Table 4 of the 1933 volume is given separately for each State)

Board of Governors of the Federal Reserve System

Statistics of international capital transactions of the United States for the first quarter of 1938 were published in the *Federal Reserve Bulletin* for July 1938.

A series of tabulations showing average operating ratios of member banks, by size groups, in the various geographic divisions and Federal Reserve districts for the year 1937 was published in the August 1938 issue of the *Federal Reserve Bulletin*. The data presented relate to the sources and disposition of earnings, the rates of earnings and losses on loans and on investments, and the rates of earnings and net profits in relation to available funds and to capital account. The ratios were computed by averaging arithmetically the corresponding ratios of individual banks, which were prepared and made available by the Federal Reserve banks.

The Board's seasonally adjusted indexes of factory employment are being revised to take account of revisions in the underlying indexes of the Bureau of Labor Statistics and of changes in the seasonal characteristics of some individual employment series. The revisions in the indexes of the Bureau of Labor Statistics reflect for the most part adjustments to the 1935 Census level. Revised seasonal adjustment factors by industries and seasonally adjusted indexes by groups and by industries are to be published in an early issue of the *Federal Reserve Bulletin*.

The Federal Reserve chart book, prepared for use of Federal Reserve officials, is now available for sale to the general public at a price of 50 cents a copy, which covers the cost of paper and printing. The chart book, which is of brief-case size, contains about 30 charts on bank credit, money rates, security markets, and business conditions. Most of the charts cover the period since 1919 and all contain space for figures through 1940 with a lightly printed grid for 1938-1940 to aid in keeping them up-to-date. A list of sources for all past and current figures is given.

*Bureau of Foreign and Domestic Commerce*¹

The retail trade series of the Current Statistical Service is being expanded to include the publication of monthly figures from independent stores in the States of Pennsylvania and Florida. Data for Western Pennsylvania are being secured in cooperation with the Bureau of Business Research, University of Pittsburgh, and a monthly report will be issued for Pittsburgh and the Western Pennsylvania area as well as the report for the state. It is also planned to publish sales changes by kinds of business for the city of Philadelphia as soon as the sample in that area can be built up. The state data will be presented to show sales by kinds of business, by city size groups, and for individual towns and cities wherever the sample is considered adequate.

In connection with studies of the National Economic Committee of which Col. Richard C. Patterson, Jr., Assistant Secretary, is a member, Dr. Willard A. Thorp, Economist for Dun and Bradstreet, Inc., has been appointed as an adviser on economic studies. The facilities of the Bureau of Foreign and Domestic Commerce will be utilized in connection with these studies.

The office of Chief Statistician of the Bureau of Foreign and Domestic Commerce, which has been vacant for some time, is filled by Mr. Ernest A. Tupper. Mr. Tupper was formerly chief of the Division of Foreign Trade Statistics.

A Division of Business Review has been established with Mr. M. Joseph Meehan as Chief. Mr. Meehan was formerly Editor of *The Survey of Current Business*. This Division will publish *The Survey of Current Business*, the weekly supplement thereto, and *Domestic Commerce*.

Bureau of Labor Statistics, U. S. Department of Labor

The Retail Price Division has completed a revision of the fuel price index to show grades and sizes of bituminous coal in more detail than has heretofore been available. The number of dealers reporting has been increased, and the indexes are weighted on the basis of estimated consumption for household heating. Rent indexes by types of dwelling have been released in mimeographed form for 20 cities.

A summary of the expenditure data for 32 cities, obtained through the consumer purchases study made by the Bureau, has been released in a mimeographed report "How Urban Families Spend Their Incomes." The families are grouped at 15 income levels, and data are shown for 2 metropolitan areas, 6 large cities, 6 groups of middle-sized cities, and 2 groups of smaller cities. There will be available in the fall a further analysis of the distribution of families by income, occupation, and family type, and of the distribution of expenditures. Bulletins showing in detail money disbursements of wage earners and lower-salaried clerical workers will also be issued shortly.

¹ See also p. 579.

A study has been completed showing average weekly and hourly earnings and average hours per week separately for full-time and part-time workers in retail trade. The data pertain to New York State and were collected by the New York State Department of Labor. The information is shown for 16 branches of trade and cover the three years 1935-37, by months. Significant differences in hours and earnings between the full-time and part-time employees were disclosed. A conference of statisticians from the 16 state offices which cooperate with the B. L. S. in the collection of employment and payrolls was held in Washington from June 20-22. An account of the conference may be found on page 575 of this JOURNAL.

Special surveys of wages and hours have been undertaken for iron and steel and for the radio transmission apparatus industry. Work is nearing completion on similar surveys of electrical machinery and apparatus, furniture, meat packing, woolen and worsteds, and fertilizer. The study of entrance wage rates of common labor, made annually as of July 1, is in progress.

Production in prison industries is the subject of a special study recently issued. It compares production and conditions of prison labor in 14 states in 1936 with earlier years. Two new surveys of labor requirements have been made, dealing with the sand and gravel, and electrical apparatus and supplies industries.

There is in preparation a manual on industrial injury statistics. It will deal with methods of collecting, coding, analyzing and presenting these data, with particular emphasis on the coding of accident causes in line with the newly developed Heinrich cause code. Standard forms for reporting industrial accidents, suggested office record forms, and the types of tables essential for the use of state administrative bodies dealing with workmen's compensation will be included. The manual is intended to replace B. L. S. Bulletin 276, "Standardization of Industrial Accident Statistics," which was issued in 1920.

Women's Bureau, U. S. Department of Labor

The Women's Bureau of the Department of Labor has just completed nation-wide surveys of wages and hours in the evaporated and condensed milk industry, in cereal plants, and in drug and medicine manufacturing plants. The Bureau is now making an intensive study of labor problems in the canning and dried fruit packing industry to meet several needs: (1) to furnish a basis for development of feasible methods of establishing state minimum wage rates and hours regulations in canneries by state minimum wage commissions; (2) to furnish the Public Contracts Board with 1938 wages and hours conditions within the canning and dried fruit packing industries, as well as with a picture of the seasonal variations in earnings and hours, in order to permit the establishment of minimum prevailing rates for government contracts on an enforceable basis; (3) to permit the administrator of The Fair Labor Standards Act to interpret the Act as it relates to the Canning Industry in accordance with current facts on opera-

tions; and (4) to furnish the Unemployment Compensation Division of the Social Security Board with data concerning the volume of employment during the year in order that equitable adjustments may be made in unemployment compensation regulations.

Bureau of Old-Age Insurance, Social Security Board

The present statistical program of the Bureau of Old-Age Insurance includes three types of statistical studies. The first of these consists of administrative statistics showing the development and progress of the operation of Title II of the Social Security Act; the second consists of vital statistics which are by-products of the record-keeping operations of the Bureau, and the third, wages, pay rolls, and employment statistics which are obtained in the course of keeping records necessary to the payment of benefits.

The most significant of the administrative statistics may be divided into three main categories: (1) statistics on claims and account numbers activities of the field offices of the Bureau, (2) quantitative statistics of record-keeping operations in the Baltimore Office of the Bureau, and (3) statistics on claims operations in the Washington Office of the Bureau.

The current information concerning claims and account numbers activities and other items which are of particular interest to persons outside of the Bureau are included each month in the *Social Security Bulletin*.

In the course of the adjudication of claims and the granting of account numbers to wage earners, certain facts are collected concerning all holders of account numbers, especially the age, sex, and color. A sample study of these characteristics has recently been made, which includes ten per cent of all persons who applied for account numbers up to January 1, 1938, and a complete tabulation of those persons applying for such numbers since the beginning of 1938 is being made monthly. Results for January-April 1938 were published with *Social Security Bulletin* for June 1938.

The second type of information obtained in the operation of the Old-Age Insurance program consists of some of the facts gathered in the adjudication of claims. A sample study has been made to determine the significance and adequacy of this information for statistical purposes, and a punch card has been designed for use in the analysis of the claims filed beginning in 1938. The items to be included in the study are the personal or social characteristics of the wage earners themselves, including occupation, sex, color, age, and number of children; certain facts concerning the heirs or payees, and in the case of death claims last illness and funeral expenses. Periodic tabulation of this material will be made perhaps on a quarterly basis.

In developing an occupational classification, the Bureau is attempting to incorporate its needs into the broader problems of occupational classification being studied by the Committee on Occupational Classification appointed by the Central Statistical Board and the American Statistical Association.

The third type of statistics being developed by the Statistical Section of the Bureau covers earnings and employment data which are available from the reports required by the Treasury in connection with the collection of taxes under Title VIII of the Social Security Act. Present plans for tabulations of these reports for 1937 include: (1) The number of employers making returns, the number of wage reports, the taxable pay roll, by size of the employing organization as measured by the number of employees. These tabulations will be by industry and by State, as well as by other geographical divisions. (2) The number of employees for whom returns are made, the number of wage reports, total taxable earnings by age, sex, and race, and by State. Separate tabulations are being made for the first and second six month periods of 1937, with a summary for the year

*Division of Research, Statistics and Records,
Works Progress Administration*

Statistical reporting procedures have been revised in order to conform to administrative changes made necessary by the Work Relief and Public Works Appropriation Act of 1938. Under the Emergency Relief Appropriation Acts of 1935, 1936, and 1937, funds were appropriated to the President who made direct allocations to the various Federal agencies participating in the Works Program. Under Title I of the 1938 Act, funds are appropriated by Congress directly to the Works Progress Administration and it is authorized to allocate up to \$60,000,000 to other Federal agencies for operation of projects of a type similar to those operated by WPA. Statistical reports covering such Federal agency projects will be secured by the Works Progress Administration in addition to continuation of reports regularly prepared for projects operated directly by the WPA and by the National Youth Administration.

Tabulations of employment and payrolls on other projects financed from Federal funds, including other titles of the Work Relief and Public Works Appropriation Act of 1938, will be compiled by the Division of Construction and Public Employment in the Bureau of Labor Statistics.

Reports of physical accomplishments on WPA projects since October 1, 1937, when the last summary was made, are being prepared for tabulation. The new data will cover all units of work completed on WPA projects placed in operation from the beginning of the program in the summer of 1935 through June 30, 1938.

Studies based on the records formerly maintained by the Area Statistical Offices through November 1937 will be completed by September 1, 1938. A tabulation showing the assigned occupations of workers employed on WPA projects during the month of November 1937 has been completed and is available. A detailed analysis of labor turnover by months from the beginning of the WPA program through November 1937 is being made and data on duration and continuity of WPA employment are being compiled for all states and for major urban areas.

Division of Social Research, Works Progress Administration

Survey of Youth in the Labor Market. This survey will give particular attention to the transition of youth from school to regular productive activity. The work records of these youth will be examined with reference to their school attainments, personal characteristics, and background at the time of entering the labor market. The survey is now operating in seven representative cities and will approximate 25,000 completed schedules.

Analytic Index of Social Statistics Two years ago the Division of Social Research, Works Progress Administration, established a card catalog of statistics concerning relief and related subjects. This index maintains the major cross tabulations of statistical material by the use of interrelated subject headings which have been classified under more than 800 main categories. Approximately 2,000 reports, published by both public and private agencies, have been analyzed and indexed. The Index is available for reference in Washington to research workers and other persons who are interested in relief and related subjects.

Relief Needs and Employment Possibilities A survey to determine the adequacy of current relief programs, the reemployment possibilities of Works Progress Administration workers and the absorption of these workers by private industry was recently made in nine of the cities which had been similarly surveyed during the summer and fall of 1937. This survey showed that there is considerable local diversity in relief policies ranging from definitely unsatisfactory to fairly adequate.

Cultural Regions Within the Rural-Farm Population. The delineation of socio-economic regions and sub-regions for the rural-farm population of the United States based on various pertinent indices has been completed and twenty-nine major regions containing 210 sub-regions have been delimited and mapped. A mimeographed statement of methodology has been prepared. Ultimately, cultural sub-regions within the rural-nonfarm population will also be delineated. It is planned to unite these two types of groupings to obtain regions of relative homogeneity with respect to the combined rural-farm and rural-nonfarm population. The Urban Section of the Division of Social Research is assembling material for the preparation of a similar memorandum for the classification of cities.

Study of Labor Changes and Relief in the Cotton Belt. A survey of the operations of cotton plantations is being conducted in Arkansas, Georgia, Louisiana, Mississippi, North Carolina, and Texas. Plantations in the first five of these States were previously studied in 1934 and reported in "Landlord and Tenant on the Cotton Plantation" by T. J. Woofter, Jr. The purposes of this survey are to analyze the changes which have taken place in the relief situation since 1934. The trend in mechanization and developments in cropping and other farm enterprises are also being studied with respect to their effect on the availability and utilization of labor.

Graduate School of the Department of Agriculture

The results of the deliberations of a committee on the unification of the mathematics and statistics courses have been published in the 1938-39 announcement of courses given by the Graduate School of the Department of Agriculture. All mathematics courses given have as their aim the preparation of the student for some branch of statistics. A course in algebra is taught by Harry J. Winslow as a prerequisite of the "Introduction to Statistical Analysis" given by B. R. Stauber and G. E. Ockey. Following this elementary course directly are "Statistical Laboratory" (Dr. B. Aitchison), "Index Numbers and Time Series Analysis," "Correlation Analysis" (C. M. Purves), and "Statistical Treatment of Experiments in the Plant and Animal Industries" (Dr. A. E. Brandt). In addition to algebra and some statistics, "Trigonometry and Geometry" (Harry J. Winslow) is required before taking Alexander Sturges' course in "Interpretation of Statistical Calculations."

Then follows a series of more advanced courses in statistics. Calculus (given alternate years) is a prerequisite for Dr. W. E. Deming's course in "Least Squares," for which the text will be his book under the same title recently published by the Graduate School. He also gives "Calculus of Finite Differences." Two courses are given by Mr. M. A. Girshick, the first is "Linear Algebra" which can be followed by "Multivariate Analysis." Dr. Max Sasuly offers two unusual courses in advanced statistics: "Analytic Curve Fitting" and "Dynamic Analysis of Time Series." "Higher Algebra" (Dr. E. A. Rasor and D. C. Bronson), and "Advanced Calculus" (A. Wertheimer) supplement the previously given mathematics courses in building a foundation for courses in statistics and statistical theory. "Special Topics in Statistics" will be a series of lectures given by outstanding specialists in their particular fields.

Five lectures on "Some Relations between Certain Continued Fractions, Orthogonal Polynomials and Stieltjes Integrals" were given before the statistics seminar this spring by Dr. C. Winston. The plan is to have these lectures hectographed, thus making 60 or 70 copies available. The lectures given by Dr. Walter A. Shewhart of the Bell Telephone Laboratories under the sponsorship of the Graduate School will also be published soon.

The Civil Service Commission informed the Department of Agriculture that the Commission will accept direct certification of those courses given by the Graduate School that are of graduate or college grade. This procedure will benefit those who desire recognition for credit courses in the Graduate School in connection with the Civil Service examinations.

Brookings Institution

The Brookings Institution has under way a study of the organization and functioning of the system of odd-lot trading used on the New York Stock Exchange. The study is in charge of Dr. Charles O. Hardy. The lead-

ing odd-lot houses are cooperating in furnishing statistical information for this study.

The American capital market, its nature and functions, and its relation to the country's economic system as a whole is the subject of a group project now in progress at the Institution.

Research Projects at Dun & Bradstreet, Inc

Mid-Year Inventory Survey The Business Trend Survey announced in the March issue of this JOURNAL, and described in some detail in the June issue, proves to be of such wide interest that it was decided to bring the inventory portion of the study up to date as of June 30th.

If questionnaire returns are a safe index of interest, then the inventory problem is certainly a live subject. A very simple questionnaire was sent out about July 14th to 23,500 concerns who had furnished useable schedules in last winter's survey. Within two weeks, over 70 per cent of these questionnaires and a continued flow up to the date of this writing, August 11th, has brought the returns above 78 per cent with a large possibility of running over 80 per cent. In addition to this questionnaire canvass by mail, the Dun & Bradstreet branch offices are making telephone or personal calls on about 2,500 of the large corporations throughout the country, to insure that the inventory information is furnished in useable form and as promptly as possible.

The trend of inventories from December 31st, 1937, to June 30th, 1938, is being compiled by industries and trades and for the U. S. in total. It is now planned to close the returns on August 15th and have a preliminary press release available soon after the first of September with final, complete tabulations available in the October issue of *Dun's Review*.

CHAPTER ACTIVITIES

The Albany Chapter

A dinner meeting was held on April 26, with 34 members and guests present. The speaker was Dr. Arthur W. Bray, Professor of Biology, Rensselaer Polytechnic Institute, Troy, New York. He gave an excellent philosophical discussion on "Probability and Its Implications in Everyday Life." Dr. Bray's talk was extremely stimulating in that it attempted to tie up underlying philosophies with the more purely statistical concepts of the present time. There was lively discussion from the floor.

Dr. W. W. Coxe gave a progress report on the work of the Committee on Professional Standards for Statistical Workers, of which he is Chairman. This Committee is working on the problem of securing more satisfactory salary allocations for the statistical workers in the service of New York State than is provided for in the present law governing allocations of statistical workers to salary grades.

On May 10, a dinner meeting was held at which 29 members and guests were present. The speaker was Mr. R. E. Wareham, General Electric Company, Schenectady, New York, on the subject, "Statistical Technique as a Tool for Industrial Control." Mr. Wareham stated that the application of statistical methods in mass production industries provides a means of controlling variations in quality. The steps in setting up this control are as follows: (1) determine the actual quality characteristics of the product; (2) show what variations in quality are permissible as "chance causes"; and (3) if these chance limits are exceeded, locate and correct the "assignable cause."

He further stated it may be recognized that in the field of large scale production even a small reduction in cost means substantial savings to business. These savings are passed on to the consumer in the form of lower selling prices. Quality-control technique provides tools for reducing these costs and for improving quality. Mr. Wareham discussed a specific case showing the application of statistical methods and tools.

At this meeting the following officers were elected for the next year: President, F. J. Decker; Vice-President, C. M. Armstrong; Secretary-Treasurer, Miss Mildred Lauder; and Directors, E. H. Van Winkle and Roland F. Bucknam.

The Austin Chapter

The Austin Chapter held its fourth and final regular meeting of the academic year 1937-38 on May 5, 1938. The main address was delivered by Mr. Garth Daniel, Statistician, Texas Old Age Assistance Commission, who reviewed the work of the statistical department of that organization and described generally the methods of procedure adopted by the Commission. Mr. Daniel pointed out several projects of a statistical nature which were being planned and described some of the obstacles involved. A considerable portion of his time was taken in answering questions put by his listeners,

the meeting concluding with a general round table discussion of the subject of old age assistance

Officers of the Chapter for the ensuing year were elected as follows: President, Dr. Edward L. Dodd; Vice-President, Mr. H. G. Heard, Secretary, Mr. A. P. Vickery. An executive committee consisting of the retiring officers and the incoming officers was authorized to function as a coordinating agency in planning the activities of the Chapter for the coming year.

The Boston Chapter

A special meeting of the Boston Chapter was held at the Massachusetts Institute of Technology on Thursday evening, June 16, 1938. There were 46 members and guests present. After the dinner a short business meeting was held, at which Mr. Edmund S. Cogswell, First Deputy Commissioner of the Massachusetts Department of Insurance, was elected President of the Chapter.

Dr. Carl Snyder, for many years with the Federal Reserve Bank of New York, discussed the subject "High Profits and High Wages." His address was illustrated by numerous charts, displayed by lantern slides. A summary of his address, reported by Dr. Wilfred S. Lake, follows:

"Why is the United States so rich? Abundant natural resources is not the answer, because Mexico, our next door neighbor, has great resources but is not wealthy, and has a wage level about one-tenth that of the United States. The basic explanation is simple: wealth comes from the supply of capital and will be greatest and will increase most rapidly where there is the most capital. Further, the greatest wealth is found where there is the greatest concentration of wealth.

"This thesis is substantiated by the statistical evidence afforded by the graphic comparison of numerous relevant series. Particularly significant is the striking correspondence between the curves representing the increase of production and the increase of capital invested in manufacturing. It appears that for every billion dollars of new product we must invest about $1\frac{1}{4}$ billion of new capital.

"Why are our wages so phenomenally high, the highest ever known? The answer lies in the relation between wages, national income, and capital accumulation. An analysis of the division of income in all manufacturing since 1849 reveals that the share of wages, aside from the early years when capital was being added very rapidly, has been nearly constant. Even such an industry as clothing, which became unionized in 1899, exhibited only a slight increase in the wage percentage after that date. Furthermore, it should be noted that total dividend and interest shares have usually been small, between 5 and 8 per cent.

"When we turn to comparisons since 1850 of wage and salary payments, based upon the index of the Federal Reserve Bank of New York, with various pertinent series, we discover the clue to our problem of high wages in the close similarity between wages, capital invested, and horse power per wage earner. Hence, we may say that the increase in mechanical equipment

is the sole way to increase wages. Wages seem to be a functional part of the system and have not been affected by the growth of unions nor by much ado about monopolies. Indeed, to calculate wages we merely need to know the rate of growth of production, the total product, and the price level.

"Whence came this great increase in capital? Look at the curves for industrial production and industrial profits. They move together, closely, when both are expressed in standard deviation units. Industrial profits, according to statistics on the sources of income for 1923, 1926, and 1929, go largely to the wealthy, as dividends and capital gains. Since only 60 per cent of the 500,000 corporations in the country paid dividends even in 1929, yet accounted for 90 per cent of the total volume of corporate business, the working control of industry is in the hands of the wealthy, those with incomes of \$40,000 or over. They are the owners of industry, less than 100,000 people, or some 60,000 families. The comparison of new corporate issues with dividends, net profits, and gross income gives added testimony to the statement that capital emerges primarily from profits. It is doubtful whether the worker contributes over 3 per cent of the total capital invested in industry.

"To conclude: wages are a fixed part of the national income, apparently not greatly altered in a century. National income equals national production in dollars, and national production is due to mechanical equipment or horse power employed, in fact, is almost a function of capital supplied or invested. In all industry production increases *pari passu* with capital investment, and in no other way. Since wages increase only when income increases, all the unions on earth, and all efforts to raise wages by law are like commanding the clouds to change their shapes. If, then, we can raise wages solely through increasing income, one way only is open—increase of capital investment. The law is inexorable. eliminate profits and there can be no increase in capital, and therefore no increase in wages. High wages are a simple function of high profits."

The Chicago Chapter

The sixth and last meeting for 1937–38 of the Chicago Chapter was held May 16th. Officers for the 1938–39 season were elected as follows: President, Henry B. Arthur, Swift & Company; Vice-President, Theodore O. Yntema, University of Chicago; Secretary-Treasurer, Miss Frances Hay, Standard Oil Company (Ind.); and Directors, John H. Noble, Armour and Company; Harold Davis, Northwestern University; and Donald W. Hansen, Illinois Bell Telephone Company.

The speaker of the evening was Dr. Jacob Viner, Professor of Economics at the University of Chicago and recently Special Assistant to the Secretary of the Treasury, Washington, D. C. Dr. Viner discussed criteria and problems of monetary control.

The Chicago Chapter has had a very active season, with an increase in membership of 25 per cent and an average attendance at meetings of 74.

The Cleveland Chapter

The eleventh annual meeting of the Cleveland Chapter was held at the Cleveland Chamber of Commerce Club on May 12, 1938. Forty-two members and guests were present Dr Carlton presided.

Mr. L. M. Whittington, Chairman of the Nominating Committee presented the following nominations for officers for 1938-39: Mr. John W. Love, President; Mrs Frida F Selbert, Vice-President; Mr E. A. Stephen, Secretary and Treasurer. No other nominations were offered and the nominees were unanimously elected

Three papers were presented at the meeting. Dr L. Dewey Anderson, Professor of Psychology at Western Reserve University, spoke on the subject, "Motor Skills " The address concerned the results of tests of physical endurance and skill subjected to children of both sexes in the Cleveland schools About 4,000 children submitted to these tests Schools were selected for the tests where there were pupils who represented a good sample of Cleveland's population as to race and economic status The talk was illustrated with a variety of wall charts. In general, the tests showed that the boys were superior to the girls in both strength and skill. The average strength and skill of the 18-year olds were used as a measure of maturity. A high degree of maturity was reached at varying ages, depending upon the type of test conducted. The tests revealed that the training for sports should begin at an age depending upon the age at which the majority reach maturity In general, the athletes scored higher than the non-athletes.

Mr Tell Berna, Manager of the National Machine Tool Builders' Association, spoke on "Tools of Industry " The talk concerned the growth and importance of the machine tool industry. Lantern slides were used to illustrate the address Mr Berna traced the development of the industry since 1760 when Watt developed a machine to construct the steam engine. The size of the average machine tool plant is small as is the total industry Management is conservative The industry requires a high degree of skill in its labor and a man of advanced years is an asset to the industry. Because the volume of business is highly fluctuating, it is difficult to keep a crew together since a good machine tool man is highly desirable in other industries. There are usually three poor years to two good ones. While there are violent fluctuations in orders, the manufacturing activity is not quite as violent since the companies operate with large backlogs of orders in prosperous times At the present time, the smaller customers are more reluctant to buy than the larger ones. About 25 per cent of all machine tools are sold to automotive customers, 40 per cent including the accessory companies.

A comparison of the index of orders for machine tools with the Reserve Board's index of industrial production revealed that both indexes decline at about the same time but that the machine tool index lags on the upturn. This may be due to exhaustion of cash. Wage rates may be favorable and costs are low. New tools are not needed so badly. The index of machine tool orders is no basis for a forecast of industrial activity.

Mr Berna discussed the increase in efficiency made possible by the use of modern machine tools. He stated that new machinery does not usually create unemployment. A chart which compared population growth with the number of persons employed revealed a faster growth in employment than in population. Another slide compared the decrease since 1899 in the hours of work in factories with the increase in hourly wage rates.

Mr Howard W. Green, Director of the Real Property Inventory of Metropolitan Cleveland, gave a talk on the "Development of Cleveland during the Past Century." An interesting series of maps were presented which showed the number of lots created by five year intervals. The largest amount of activity took place from 1870 to 1874 when 28,000 lots were created. Another series of maps showed the lots created on a cumulative basis. This study will be of considerable value in forecasting the areas of future growth in sub-lots, building, and population.

The Connecticut Chapter

A meeting of the Connecticut Chapter was held on April 25. Mr W. R. Williamson, Actuarial Consultant of the Social Security Board, Washington, D. C., spoke on "Some Phases of Unemployment Benefits." On June 6, Professor Gunnar Myrdal spoke on "Housing Problems and Housing Policy in Sweden" at a joint meeting of the Connecticut Chapter and the Yale Economics Club. Dr. Myrdal is Professor of Political Economy and Director of the Social Science Institute at Stockholm University and is a member of the Swedish Parliament. He has been adviser to the Social-Democratic government on population, housing, and finance.

The Madison, Wisconsin Chapter

The group interested in the formation of a local chapter of the American Statistical Association in Madison, Wisconsin, held preliminary organization meetings on April 1 and April 8. The proposed charter and by-laws were drafted and submitted by the sixteen local members of the American Statistical Association to the parent body for approval, and a charter was granted late in April.

Subsequently the following officers were elected: President, Professor Harry Jerome of the Department of Economics, University of Wisconsin; Secretary-Treasurer, Professor Philip G. Fox of the School of Commerce, University of Wisconsin; and Vice-Presidents, Professor W. P. Mortenson of the Department of Agricultural Economics, University of Wisconsin, Mr. Claude S. Holloway of the research staff of the Wisconsin Taxpayers Alliance, and Dr. Walter H. Ebling, Chief, Division of Agricultural Statistics, Wisconsin Department of Agriculture and Markets. The membership of the chapter numbers about thirty-five and consists chiefly of three groups: persons associated with the University of Wisconsin, statisticians with various departments of the state and federal government in Madison, and statisticians associated with business and industry. The three Vice-Presidents are designated as representing respectively these three groups.

The first program meeting of the chapter was held on May 2, with an attendance of about forty. Dr. Oskar Morgenstern, Director of the Österreichisches Institut für Konjunkturforschung at Vienna, prior to the annexation of Austria by Germany, explained the activities of the Institut with special emphasis on the development of cooperation between his organization and similar bureaus in other European countries. At a program meeting on May 18, the chapter was favored with a discussion by one of the Association's Vice-Presidents, Dr. Halbert L. Dunn, Chief of the Vital Statistics Division of the Census Bureau. Dr. Dunn discussed some of the special problems met in conducting the work of the Bureau, particularly the problem of maintaining comparability and at the same time improving the precision of definition and the scope of the data collected.

The Pittsburgh Chapter

Wilbert G. Fritz, Statistician and Financial Economist, Bureau of Business Research, University of Pittsburgh, discussed the "Index of Business Activity in the Pittsburgh District, 1884-1937," before a meeting of the Pittsburgh Chapter on April 28. At the meeting on May 26, Charles A. Carpenter, District Manager of the U. S. Department of Commerce, discussed "The Use of Specialization as Against Generalization in Attempting to Forecast Trends." The June meeting was a joint meeting with the Chamber of Commerce and the Kiwanis Club to hear Walter A. Jones describe "The New All Weather Turnpike Across the State." The subject of the July meeting was "Changes in Steel Prices and Elimination of Pittsburgh as the Basing Point." R. L. Hartford, local representative of "Steel" and Glenn E. McLaughlin, Bureau of Business Research, University of Pittsburgh, initiated the discussion of these recent changes and their probable effect on the steel industry and the Pittsburgh industrial district.

The San Francisco Chapter

Professor George F. McEwen, of the Scripps Institution of Oceanography, spoke at a meeting of the San Francisco Chapter on April 21 on "Some Statistical Problems Arising in Long-time Weather Forecasting in California." He pointed out that an accurate determination of the relationship between seasonal weather and conditions in the ocean is highly necessary, for example, in the kelp industry. Kelp is a commodity of great commercial value which is harvested seasonally. If temperatures are high, it is difficult to harvest and is in poor condition. It is possible to project monthly averages of daily observations of surface temperatures on the assumption that previously observed conditions will determine temperatures several months in advance. In general, three months is about as far in advance as a forecast can be made to be of sufficient reliability for practical use. For precipitation forecasts, observations at six low altitude stations in Southern California have been smoothed to find cyclical relationships.

Hydraulic engineers are confronted with a great variety of problems, the question of flood control, the question of designing of drainage systems,

dealing with long-time projects—dams, etc. The knowledge of the relationship between ocean temperatures and seasonal run-off of rivers is highly valuable in determining what type of structure will be necessary to take care of run-off of rivers from year to year. Since it has been established that surface ocean temperatures have some correlation with the run-off of rivers as well as with precipitation, it is possible by means of this relation and cycle studies to estimate the run-off of rivers a year in advance. Another type of forecasting needed by engineers pertains to estimating, from short series of records, the probable extreme values to be expected in a long interval, fifty or one hundred years.

Dr Vergil D. Reed, Assistant Director of the U. S. Bureau of the Census, spoke before a joint meeting of the San Francisco Chapters of the American Statistical Association and the American Marketing Association on July 18. His subject was "Needs and Recent Developments in Marketing Research Statistics—Government and Private."

The Washington Statistical Society

A meeting of the Washington Statistical Society was held at the Cosmos Club on April 26 to consider the question "Are We Progressing Toward a Standardized Concept of National Income?" The chairman of the meeting was A. D. H. Kaplan of the U. S. Bureau of Labor Statistics. Robert G. Martin, of the National Industrial Conference Board; Maurice Leven, of Brookings Institution; and Hildegard Kneeland, of the National Resources Committee, were the principal speakers.

The following officers were elected for 1938-39. President, Halbert L. Dunn, Bureau of the Census; Vice-President, O. E. Kiessling, Bureau of Mines; and Secretary-Treasurer, Thomas B. Rhodes, Works Progress Administration.

Professor Gunnar Myrdal addressed the Washington Statistical Society and the Washington Chapter of the American Sociological Society on "Social and Economic Planning in Sweden" at their joint meeting on May 31.

NEW MEMBERS

- Anderson, Professor Don S, Associate Professor, Department of Agricultural Economics, University of Wisconsin, Madison, Wisconsin
- Anderson, Paul E, Associate to Consultant Engineer and Economic Adviser, United Mine Workers of America, Washington, D. C.
- Aylesworth, Dr Evelyn, Supervising Statistician, School of Forestry and California Forest and Range Experiment Station, University of California, Berkeley, California
- Borwick, Peter M, Assistant Statistician, U S Housing Authority, Washington, D. C.
- Bottecher, William J., Junior Agricultural Statistician, Bureau of Statistics, New York State Department of Agriculture and Markets, Albany, New York
- Brown, Dr. Bonnar, Special Assistant, Division of Security Loans, Board of Governors of the Federal Reserve System, Washington, D. C.
- Brown, Daniel K, Investigator, Board of Equalization, State of California, Santa Ana, California
- Carmichael, Professor Dan J, Assistant Professor of Business Administration, Drake University, Des Moines, Iowa
- Cassen, Philip N, Student, Brooklyn College, Brooklyn, New York
- Cogan, Isaac, Statistician, Wisconsin Public Welfare Department, Madison, Wisconsin
- Dorman, Robert O, Research Assistant, Unemployment Compensation Division, Connecticut State Labor Department, Hartford, Connecticut
- Dowling, Edgar J., Statistician and Market Analyst, Diamond Alkali Company, Pittsburgh, Pennsylvania
- Edwards, Wesley, 5189 Raymond Avenue, St. Louis, Missouri
- Eisner, Ruth, Associate Statistician, National Research Project, Works Progress Administration, Philadelphia, Pennsylvania
- Elder, Jeannette M, Director of Special Studies, Iowa Emergency Relief Administration, Des Moines, Iowa
- Epstein, Lenore A, Statistician, Urban Study of Consumer Purchases, U. S. Bureau of Labor Statistics, Washington, D. C.
- Field, Maxwell, Acting Secretary, New England Shoe and Leather Association, 210 Lincoln Street, Boston, Massachusetts
- Fitzsimmons, Helen P, Provincial Statistician, Department of Federal and Municipal Relations, Government of Province of New Brunswick, Fredericton, New Brunswick, Canada
- Foster, Merle A, Agricultural Economist, Marketing Section, Agricultural Adjustment Administration, Washington, D. C.
- Geiger, Laverne David, Assistant Actuary, The Industrial Commission of Ohio, Columbus, Ohio
- Giffey, Richard C., State Statistician, Michigan Works Progress Administration, Lansing, Michigan
- Gordon, Robert Dean, Research Assistant, Scripps Institution of Oceanography, La Jolla, California
- Green, Morris M., Jr, Security Analyst, Shearson, Hammill and Company, New York City
- Grove, Dr. Robert D, Junior Social Science Analyst, Division of Vital Statistics, U. S. Bureau of the Census, Washington, D. C.

- Haskell, A. Porter, Jr , Economist, National Research Project of Works Progress Administration, U. S Bureau of Mines, Washington, D C
- Hermberg, Paul G , Asesor tecnico del Contralor General de la Republica de Colombia, Contraloria General de la Republica, Colombia, South America
- Hoover, Mrs Ethel D , Assistant Chief, Retail Price Division, Bureau of Labor Statistics, Washington, D C
- Keim, Walter G , Associate Statistician, Division of Research, Statistics and Records, Works Progress Administration, Washington, D C
- Klauber, Laurence M , Vice-President in Charge of Operation, San Diego Consolidated Gas and Electric Company, San Diego, California
- Lloyd, Dr Edward L , Chief, Market Data Section, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D C
- Long, Glenn S , Head of Examining Division, Ohio State Employment Service, Cincinnati, Ohio
- McCarthy, Michael D , Lecturer in Mathematics, National University of Ireland, University College, Cork, Ireland
- McInerney, William P , Administrative Assistant, Division of Publications, General Information, Records and Religious Statistics, Bureau of the Census, Washington, D C
- Mitchell, S Robert, Assistant Research Analyst, Division of Social Research, Works Progress Administration, Washington, D C
- Parsons, Charles G , State Statistician, Works Progress Administration, Des Moines, Iowa
- Peek, Jesse H , Manager, Investment Department, United States Fidelity and Guaranty Company, Baltimore, Maryland
- Phillips, Robert Y , Assistant Coordinator of Statistical Projects, Works Progress Administration, New York City
- Platt, C Spencer, Assistant Manager, Social Security Board, Hartford, Connecticut
- Reed, Elizabeth, Assistant Statistician, Bureau of Pneumonia Control, New York State Department of Health, Albany, New York
- Reeve, Mrs Virginia D , Student, Utah State Agricultural College, Logan, Utah
- Rogers, H. Gordon, 479 Ridge Street, Newark, New Jersey
- Short, C M , Assistant Secretary, The Canadian Bank of Commerce, West Toronto, Canada
- Wendt, Laura, Associate Statistician, Bureau of Research and Statistics, Social Security Board, Washington, D C
- Wester, Samuel O , Administrative Assistant, Area Statistical Office, Works Progress Administration, Dallas, Texas
- Winston, Dr Ellen, Senior Research Supervisor, Division of Social Research, Works Progress Administration, Washington, D C
- Winston, Professor Sanford, Professor of Sociology, State College, University of North Carolina, Raleigh, North Carolina
- Yaworski, Nicholas, Mineral Economist, National Research Project, Works Progress Administration, Washington, D C.

C. LUTHER FRY

In Rochester on April 12, 1938, the career of C. Luther Fry was terminated. Born in Philadelphia on March 16, 1894, he received his A. B. degree from Muhlenberg College in 1916, his A. M. from Columbia in 1917, and his Ph. D. from the latter institution in 1924.

The major portion of Luther Fry's life was devoted to social research, and his contributions have been many and significant. Following the World War, in which he served as a commissioned officer, he entered the field of social investigation through his affiliations with the Interchurch World Movement and its successor, the Institute for Social and Religious Research.

A lover of travel, he eagerly seized opportunities for the study of social and economic conditions in the Near East and in the Orient. On numerous occasions he was borrowed for important investigations in various parts of the world. Keenly interested in situations within our own borders, he made significant contributions, both to our knowledge of social and religious phenomena and to the techniques of social investigation.

In 1933 he was called to the chairmanship of the newly created Department of Sociology at the University of Rochester, in which capacity he served until his death. In the City of Rochester the research program which he had built had already yielded valuable results and promised even greater success in the future.

Fry was an indefatigable worker. A list of his published works is too voluminous to quote. Each document was based upon the most painstaking study, each was a distinct contribution.

As a member of the American Statistical Association he was always happy to lend his services to improving social data and to making available unpublished masses of material as well as to the critical analysis of procedures and methods of approach.

His death brings serious loss to the statistical fraternity. It will be hard to find a replacement for him in his teaching and research in Rochester. He was, however, not merely a scientist, a delver in the dusty data of the past. He was a joyous personality who will linger long in the thoughts of his many friends, both colleagues and students.

FRANK A. ROSS

NOMINATING COMMITTEE

In accordance with the provisions of the Constitution, President R. H. Coats has appointed a Nominating Committee to make nominations for officers to be elected at the next Annual Meeting. The members of the Committee are W. Randolph Burgess, Chairman, E. Dana Durand, and Frederick C. Mills.

FREDERICK F. STEPHAN, *Secretary*

BOOK REVIEWS

RALPH J. WATKINS
Review Editor

Industrial Reconstruction and the Control of Competition; The British Experiments, by Arthur F. Lucas. New York, London, and Toronto: Longmans, Green and Company. 1937. xi, 384 pp. \$5 75.

Since 1930 British industry has become increasingly involved, both from within and by government imposition, in schemes for the control of prices and production. Today, practically every industry in Great Britain, whose products and processes will permit such control, is definitely contemplating or operating under a minimum price and (less frequently) output limitation and allocation arrangement. It has remained for an American to present the best—in fact, practically the only—complete survey of the astonishing development which has transformed the fundamental character of British economy¹ within the present decade. Professor Lucas follows three introductory chapters on the background and present status of British industrial organization with separate chapters devoted, respectively, to coal mining, iron and steel, shipbuilding and flourmilling, cotton textiles, chemicals and other “com-bines,” agriculture, and an array of industries under the heading “The Trade Association as a Medium of Control.” His concluding chapters are devoted to an analysis, in the light of British experience, of the basic issues of control: the determination of prices, regulation of output, maintenance of efficiency, and economic and legal safeguards. The recital of facts in this excellent study will surprise Britons as well as Americans, and the pointed analysis and discussion are likely to result in some hasty stock-taking in the ranks of those who have been lending unthinking support to all phases of the British brand of “rationalization.”

Professor Lucas finds that England’s movement toward industrial government represents a “deliberate attempt to devise a new and improved industrial structure,” growing out of the “near collapse of the British economic system” consequent upon the two post-war depressions and the mounting inability of British industry fundamentally to retain its earlier pre-eminent place in world economy. Complete loss of confidence in “classical” competition, a need for the rehabilitation of industrial organization and equipment that could be had only through the medium of high centralization, and growing faith generally in co-operative endeavor have all found expression in the new order.

The chapter on coal mining is one of the best in the book—the description of the organization and analysis of the operation and effects of government-re-enforced cartelization, with its rigorous regulation of prices and over-all and individual output, in an industry notorious for its independent individ-

¹ The British *Economist* now talks of the “New Feudalism” (Vol. CXXXI, page 2 (April 2, 1938)); and Sir Arthur Salter, writing on the Coal Bill in the *London Times* of February 9, 1938, says, “. . . we are, by successive Acts, with regard to agriculture, electricity, and other industries, building up a completely new economic system in this country.”

ualism. It is to be regretted that the author's treatment had to stop short of the introduction of central selling and the devices contemplated in the legislation enacted by the recent Parliament. The other descriptive chapters are accurate and, in the main, quite adequate, but they lack some of the "feel" and "atmosphere" which might have made them quite distinctive if Professor Lucas had only garnished the material from printed reports with the first-hand impressions which he is in an excellent position to supply. They are good, but they seem, somehow, remote from day-to-day London, Birmingham, Sheffield, and Lancashire.

The author's critical analysis is excellent, he raises questions which the British are all too inclined to ignore—questions which will take their toll if they are not faced and dealt with, a toll that will be none the less real because it is basic and slow rather than immediately and spectacularly devastating. He does well to stress fundamental issues stemming from the central problem of adjustment in an economy of scarce resources, and his point that effective competition will not flow from *laissez-faire* is one that should be brought home to present-day English liberals.

This is a first-rate book. It is informed, well written and effectively organized, the author moves easily and with understanding. If one were to offer any criticism it would be, principally, on the score that the treatment is sometimes too formal and detached, that the author has sometimes seen studied movements where only drifting is present, that "consistent" evidence is occasionally offered as "conclusive," and that (on a matter of detail), in dealing with the law of restraint of trade the author does not distinguish emphatically or early enough between breach of contract (ancillary and independent agreements), tort, and criminal cases. The study runs back over the past fifteen or twenty years; in my judgment, the decisive break came in 1932 with the passage of the Import Duties Act and the institution of the Import Duties Advisory Committee and, thereafter, with the determined establishment of the Government's defense program—affording a necessary condition and tremendous driving force. Things have moved (or "drifted") rapidly in Great Britain since the author's last printed reference (March, 1936) but entirely in the direction which he points. One important fact has become increasingly apparent, however, by the experience of the past two years: the Government, despite its protests and misgivings and over any opposition which may be offered by industry, is inevitably and irresistibly drawn into the very texture of "industrial government" just as soon as formal competition comes to be supplanted by effective cooperation.

BEN W. LEWIS

Oberlin College

Diminishing Returns and Planned Economy, by George M. Peterson. New York: The Ronald Press Company. 1937. xii, 254 pp. \$3.00.

It is a little difficult to see why the term "planned economy" should have been attached to the title of this volume unless for the purpose of shifting

the demand curve for it to the right. The discussion of economic planning is limited to a definition and a few observations in the last chapter and to a six-page appendix called "Suggestions for Social Economic Planning in the United States "

The substance of the book is concerned with a short discussion of pedagogical methods in the presentation of economics and with a lengthy consideration of the "most important principle underlying economic relations," namely "the law of diminishing returns." The remarks on pedagogy are interesting and the analysis of diminishing returns lucid and clear-cut. The author is of the opinion that instruction in economics should proceed from simple relationships to complex and likens the presently favored institutional approach to "beginning the study of chemistry with an analysis of fertilizers, vitamins, cellulose, proteins and gunpowder "

The term "diminishing returns" is used broadly enough to cover a discussion of increasing and decreasing average, marginal and total returns in terms of physical product, costs, values, and profits. The first half of the book, however, is devoted to variations in the physical relations of two factors of production and associated variations in the physical product. Although this analysis adds little that is new, it is careful and comprehensive. Most of the remainder of the volume is concerned with the application of the principles of "diminishing returns," thus understood, to economic theory and to economic and sociological problems. Here, partly by reason of the subject matter, but also because of the number and comprehensiveness of the problems the author attempts to cover, the treatment is much less rigorous and tends even to become sketchy. The book as a whole exhibits a curious lack of cohesion and consequently does less than justice to the author's obviously considerable powers of analysis.

EDWARD S. MASON

Harvard University

The Economic Library of Jacob H. Hollander, Ph D, Compiled by Elsie A. G. Marsh. Baltimore. J. H. Furst Company. (Privately Printed) 1937. xi, 324 pp.

To review Professor Hollander's *Economic Library* in the customary formal manner would be both inappropriate and ungracious. For this handsome volume, printed and bound in the style of Ricardo's day, is much more than a catalogue of books, portraits, and autographed letters; it is a record of a long and pleasant adventure published so that other economists might vicariously share the joys of this happy adventure and profit from the fruit of Professor Hollander's harvest. No idle hope this. Here is our common heritage, 4,071 items, painstakingly collected, not with miserly selfishness but with dutiful responsibility. Those of us who have used the collection know the graciousness of Professor Hollander in sharing the actual books; those of us who have received copies of the splendid check list of his library

realize the trusteeship which Professor Hollander has assumed for himself; those who will consult the *Economic Library* in reference rooms will find their path made easier through his help

Fifty years ago, no systematic collections of historical economics existed. Today we have at least four Foxwell's first collection (now the Goldsmiths Library), Seligman's collection (now in the Columbia University Library), Foxwell's second collection (now the Kress Library at the Harvard Graduate School of Business Administration), and Hollander's. I have used all four, and I feel duty-bound to express publicly my gratitude to the men who brought these collections together. The tasks which these three collectors set for themselves were not identical; as a result the collections complement each other. Among other things, for example, Professor Hollander has striven to reassemble as much of the famous Massie collection as possible. Finally, he has given us this magnificent printed record of his faithful work which will serve us as a most useful tool and will remind us that we also have responsibilities to those who follow us.

E. A. J. JOHNSON

New York University

Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States since 1856, by Frederick R. Macaulay, with a preface by Wesley C. Mitchell. New York: National Bureau of Economic Research. Publication No. 33. 1938. 500 pp., 33 tables, 32 charts. \$5.00.

This volume is much more than a book on interest rates and security prices, as suggested by the abbreviated title on the cover. The full title gives a much better indication of its contents, but even that does not lead the reader to expect all that he finds. The sections of the philosophical introductory chapter that deal with the problems and difficulties faced by scientific investigation in the field of economics, for instance, are applicable, not only to the problem of long-term interest rates and their relationship to short-term interest rates and to other economic phenomena but also to almost any line of investigation in the general field of economics.

This chapter has now appeared in reprint form and should be read with profit by economists and statisticians generally, even though they may not be primarily concerned with the subject of interest rates. The prevalence of attempts to forecast one thing or another, on the basis of evidences of empirical relationships between two or more statistical series, more than justifies the caution given by the author that acceptance of such evidences as though they were explanations may easily become a delusion and a snare. As Dr. Macaulay also says in his introduction, "if no explanation of why a fundamental relationship should exist can be supplied by other than a grossly *ad hoc* hypothesis, the 'generalization' may 'work' for years and then fail forever." Later on, in a digression suggested by the high coefficients of correlations that have been derived by others from comparisons of interest

rates and commodity prices, he discusses at some length the need for careful examination of the relationships between the series that produce such coefficients before concluding that there is convincing evidence of a direct causal connection between them.

In other respects the introductory chapter provides a setting for the treatment of problems that are considered in the subsequent chapters, as for instance, the need for careful definition of the problem before attempting to solve it. Before discussing even the measurement of long-term interest rates, Dr. Macaulay defines the significance of such rates and their theoretical relationship with short-term interest rates. The yield of a bond is defined as a single rate, such that the present value of all future payments of interest and principal, when calculated by assuming this rate, would equal the price paid for the bond. The yield theoretically should be an average of the various short-term rates of interest in successive future periods during the life of the bond. Such rates, being in the future, cannot of course be known but are implicit, and the implicit rates rarely correspond at all closely to the actual rates. The implied forecasts of future interest rates that are indicated by the pricing of serial bonds are frequently quite different for securities of the same maturities offered by different borrowers at approximately the same time. It is evident, therefore, that the pricing of the bonds is based on rough and ready guesses as to the yields that will sell the bonds, rather than on any definite set of forecasts of future interest rates.

In the pricing of any bond a second type of forecast is also involved—a forecast of the degree of certainty of the future payments. The realized yield may be quite different from the promised yield, and there can never be absolute security of future payments. The concept of “pure” or “riskless” interest, therefore, is metaphysical.

A new concept introduced by Dr. Macaulay in the course of his discussion of bond yields is that of “duration,” which takes into account the rate of interest paid on a bond as well as its maturity. Of two bonds having the same yield and the same maturity, the bond with the higher coupon rate has the shorter “duration,” as a larger proportion of the total payments will have been made at any given time prior to maturity than on the bond with the lower coupon rate.

In constructing his index of bond yields over the period from 1857 to 1936, Dr. Macaulay used railroad bond prices because sufficient quotations for any other homogeneous group of high-grade bonds were not available and even with them encountered many difficulties in eliminating the influence of factors other than changes in long-term interest rates. A chain method was necessary, since a changing list had to be used to cover so long a period; furthermore, bonds could be included for only a part of their life, as their yields were affected by their nearness to maturity. Even with that procedure, it was found that quotations for individual bonds were affected by economic “drift,” which involved actual, if not nominal, changes in their grades. An ingenious method was devised to eliminate this “drift” in the construction of the index. Economic “drift,” when segregated from the movements of

long-term interest rates, as such, was found to correspond much more closely with the movements of common stock prices than did the movements of long-term interest rates.

Common stock prices reflect the market's estimate of future earnings and dividends, and lower grade bonds partake of the nature of both the higher grade bonds and common stocks. Dr. Macaulay takes the position, however, that a cyclical decline in stock prices is primarily a result of pressure rather than of a change in anticipated earnings, important as such a change may be, owing to the fact that stocks, to a much greater extent than bonds, are carried on loans—a position which may be open to question, even though, after a slump in the market sets in, credit liquidation is unquestionably an important factor.

An even more questionable conclusion is that the cyclical movements of high-grade bonds and of stocks have essentially the same relation to the business cycle, since both are determined by the attendant cycle of confidence, especially on the down-swing of the cycle, because the demand then is not primarily for more secure investments but rather for more cash. But a tendency for cyclical rises in bond-yield indexes to precede, rather than to follow, cyclical declines in business indexes, is demonstrated in the last chapter, and it is not difficult to find instances of an *increased* rather than a *reduced* demand for high-grade bonds, and a decline in their yields, after a downturn in business has started. May not the cyclical movements in bond yields, except in periods of extreme depression, be related more indirectly to cyclical fluctuations in business than is explained by the cycle of confidence—through the effects of expanding or contracting business volume and changes in prices on the “money market” situation, and thus on short-term interest rates, which in turn affect long-term rates? A detailed analysis and discussion of the *actual* as distinguished from the *theoretical* relationships between long-term and short-term interest rates is not presented in this volume. Perhaps it may be expected in the subsequent volume, referred to in a footnote in the introduction, which is to contain “the tables and charts concerned with the relations of the rates and yields to credit and banking conditions, with the theoretical and statistical discussion of those aspects of the subject.”

In Chapter VI the author raises serious questions concerning the presumably well-established correlation between commodity prices and interest rates. He finds that high coefficients of correlation can be obtained only by selecting certain periods and suggests that the lack of correlation in other periods is so glaring as to demand explanation. He examines the various theories as to reasons for the assumed relationship and finds none of them convincing. He presents an alternative hypothesis which, however, he admits “is almost as difficult to reconcile with parts of the actual rates and prices as are some of the theories upon which we have so adversely commented.”

The final chapter presents comparisons between a number of series of data on interest rates, commodity prices, and business volume, with trends

eliminated to facilitate comparisons of cyclical movements. The procedure followed in trend elimination, however, is such that it is not too clear just what is the significance either of the trends or of the cyclical fluctuations obtained by computing deviations from the trend lines

From the comparisons of cyclical movements thus computed, certain average leads and lags between the various series are found. The reader is cautioned that any degree of confidence in the accuracy of any averages is entirely unwarranted—that they may well be more misleading than enlightening—but the author concludes that the study of the relative timing of different economic series is at least more promising than the attempt to develop rigid cyclical formulas

The volume ends as it starts, in a philosophical vein, with a discussion of the need, not only for a growth of knowledge and with it greater accuracy of forecasting, but also for greater effort to do those things in the present that will reduce the violence of economic disturbances in the future. "We must make the future and not merely forecast it."

More than half of the book is taken up by tables and charts, but the space devoted to the discussion is extraordinarily meaty. The volume is obviously the result of an immense amount of work and careful thinking over an extended period and merits intensive study rather than a mere cursory reading.

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Prosperity and Depression, A Theoretical Analysis of Cyclical Movements, by Gottfried von Haberler. New York: Columbia University Press. Geneva: League of Nations Economic Intelligence Service. 1937. xv, 363 pp. \$2.00

In constructing theories of the Trade Cycle, as in other connections, economists often tend to exaggerate the importance of the particular elements around which their respective theories are built, so that the analysis of a particular force operating on the business situation is presented as a complete theory of the business cycle. In the present volume Professor Haberler has rendered a useful service in a very skillful perpetration of the opposite error.

The book consists of two parts. The first part contains an extremely lucid account of the outstanding theories of the trade cycle and a masterly extraction, in the face of divergent terminologies, of points that are common to more than one theory. (It would have been interesting to know who was the author who declared his views to be unrecognizable in Professor Haberler's summary.) In this task Prof. Haberler displays much admirable ingenuity and is able to make a large number of valuable, if minor, clarifications, e.g., in making explicit the psychological implication of the "acceleration principle" of derived demand.

The second part of the book consists of an eclectic theory of the trade cycle where Professor Haberler's genius for finding everybody right surpasses itself in discovering for every theory some section of the course of the cycle to which it is applicable. One sometimes gets the impression of a host of plausible or conceivable influences on business activity being arranged by the author in an order that generates a plausible picture of the trade cycle; but to describe Professor Haberler's synthesis as being just that would be to make a vicious caricature. The division of the cycle into the four elements of expansion, contraction, down-turn, and up-turn will be a valuable device even for more unitary theories of the trade cycle.

The analysis suffers considerably from a weakness in terminology that is not unrelated to Professor Haberler's almost pious attachment to tradition and overcharitable reluctance to find anybody quite wrong. He rejects the peculiar definition of saving used by Mr. Keynes in his *Treatise on Money* ("normal" income earned in the period—excluding profits—*minus* consumption) according to which an excess of investment over saving is synonymous with the existence of profits. Neither does he accept the "common-sense" definition used by Mr. Keynes in his *General Theory of Employment, Interest and Money* (total income earned in the period—including profits—*minus* consumption), according to which saving (for the whole economy) cannot diverge from investment. He prefers to follow Mr. Robertson's alternative "common-sense" definition (income *available* in the current period—which was earned in the previous period—*minus* consumption in the current period) according to which there can arise divergences between saving and investment. Professor Haberler appears to do this in order to be able to consider the effects of these divergences—"excess saving" and "excess investment"—on the business situation.

Quite apart from all the unanswered and perhaps unanswerable questions begged by the notion of the "period" and its different length for different purposes, this procedure is unsatisfactory because it obscures the fact that on this definition an (algebraic) excess of investment over saving is *synonymous* with an increase in money income and with "inflation."

An attempt is made to save this situation by constructing a neoclassical theory of the rate of interest with saving as one of the sources of the supply of investable funds, so that an increase of saving, by lowering the rate of interest, may increase investment and there is restored the significant question of the extent to which it will have this effect. But here we get lost in a maze of time lags of different length where almost anything can happen. The effect of the increase in saving on the *demand* for "investable funds" (which of course need not mean a desire to invest them) is lost sight of, and the criteria of plausibility that are afforded by a modern liquidity theory of the rate of interest are absent. In this confusion a theoretical place is found for the "under-saving" theory of the breakdown of the boom at the cost of laying aside the obviously net deflationary effect of a decline in the demand for consumption goods (which is recognized on p. 216) and an abdication from any specific pronouncement on the general effect of public works.

It would also appear to be unsatisfactory to pair people's attitudes to their *flow* of saving and their *stock* of money as joint and parallel influences on the supply of loanable funds in the determination of the rate of interest, and a concentration throughout on *MV* certainly pays a disproportionate respect to the quantity theory of money and to the independence of *MV* and is liable to allow the student to slip very easily from *MV* or "the effective amount of money" to *M*. The inadequate distinction between stocks and flows and between levels of employment and rates of change in this level (which leads Professor Haberler himself to remarkably few mistakes) is also responsible for the unsatisfactory definitions of prosperity and depression (p. 162) that do not make it clear which we have when employment is high but falling or low but rising.

All of these and other weaknesses seem to spring from the same source—a failure to adopt explicitly the modern formulation of the theory of the rate of interest in terms of the supply of money and liquidity preferences, and to make the sharp distinction between saving and time preference on the one hand which deals with flows; and cash and liquidity preference on the other hand which deals with stocks. Should Professor Haberler overcome his dislike for this method and free himself from the incubus of the cumbersome traditional terminology, he will undoubtedly be able to use his skill to much better purpose and for more positive contributions on the lines indicated by the work of Harrod and Kalecki.

With all these weaknesses in the synthesis, the book remains a valuable handbook of the existing theories of the trade cycle and a salutary reminder of the complexity of the problem to those who tend to oversimplify.

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Studies in the Social Aspects of the Depression: Crime in the Depression by Thorsten Sellin, *Education in the Depression* by The Educational Policies Commission, *The Family in the Depression* by Samuel A. Stouffer and Paul F. Lazarsfeld, *Internal Migration in the Depression* by Warren S. Thompson, *Minority Peoples in the Depression* by Donald Young, *Recreation in the Depression* by Jesse F. Steiner, *Religion in the Depression* by Samuel C. Kincheloe, *Rural Life in the Depression* by Dwight Sanderson, *Social Aspects of Consumption in the Depression* by Roland S. Vaile, *Social Aspects of Health in the Depression* by Selwyn D. Collins and Clark Tibbitts, *Social Aspects of Reading in the Depression* by Douglas Waples, *Social Aspects of Relief Policies in the Depression* by R. Clyde White and Mary K. White, and *Social Work in the Depression* by F. Stuart Chapin and Stuart A. Queen. New York: Social Science Research Council. 1937. Bulletins 27-39, \$1.00 each or \$10.00 a set.

The social aspects of the great depression of the early 1930's cannot be adequately evaluated at present, for the various phenomena observed during

these years must be viewed against a historical perspective. When this perspective is attained, not the least important aspect may well prove to be the effect of the depression upon the sociologists themselves, as evidenced by the research approach developed in the thirteen monographs sponsored by the Committee on Studies in Social Aspects of the Depression of the Social Science Research Council.

The concept of *trends* has long been firmly entrenched in sociological theory. Social trends have been studied as important in and of themselves, but little interest has developed—up to the publication of these monographs—in the magnitude or characteristics of the recurring positive and negative deviations from these trends.

Perhaps the most important aspect of the research approach developed in these monographs is the introduction of the concept of *flux and reflux* as applied to social norms, and the recognition of the complex interrelationships between social trends and social cycles, as indicated, for example by the following quotation from the monograph on *Religion*:

Religion makes its basic changes slowly. The big question to determine is that of the degree to which the changes occurring during a time of depression were already under way and were simply speeded up or retarded by the depression, and to what extent the depression created situations so different that new factors began their work. In many cases the old trends probably continued, but were influenced by conditions due to the depression (p. vii);

or the following from the monograph on *The Family*, whose authors point out that, whereas they are dealing with a primary institution and sociological theory postulates “that the deeper the structure of an institution is rooted in the mores the more resistant is it to change,” nevertheless,

the decline in the marriage rate [during a depression] has direct demographic effects in the reduction of births, sociological effects in possibly encouraging a relaxation of sex taboos among the unmarried, and doubtless psychological effects on individuals, particularly on the women who fail to marry. Thus the family, however much or little it may alter as an institution, may play an important role as a modifying factor during depressions (p. 7);

or the statement of the author of *Minority Peoples*, who denies to the depression “an originally creative role” but points out that this denial “is not to be construed as a refusal to recognize fundamental shifts in emphasis and even reversals of trends in minority life when these are really consequences of the depression” (p. 16).

The authors were expected to define significant problems in their fields, from the point of view of possible depression effects; to evaluate the state of existing knowledge; and to point out promising and feasible research problems to further the development of this knowledge. The success of the monographs, however, lies in the structure built for future research, the introduction of business cycles as factors to be taken into account in investigations of social processes, social behavior, and social institutions, and as contributions to method; but not so much in the definition and identification of sig-

nificant depression problems, *per se*. Their relative failure in this last respect is understandable: no frame of reference existed up to the publication of this series, and, furthermore, the working hypothesis developed by the Committee that "the repercussions [of the depression of the early 1930's] were so far reaching that scarcely any type of human activity was untouched" (Foreword of all monographs, p.v) was not such as to lead to de-limitation

Whenever existing data warranted it, the historical approach was recommended; whenever these data were quantitative, this approach followed the time series type of analysis developed by the economic statisticians. This latter was feasible only in three of the thirteen fields considered, viz. the family, crime, and health. Even in these three fields, however, limitations of accessible data render analyses of other than gross relationships extremely difficult. Regarding the family, for example, Stouffer and Lazarsfeld accept as "rather well established facts" that during a depression "fewer families are begun, by marriage, . . . fewer families are augmented by births . . . [and] fewer families are broken by divorce" (p. 5) but point out that "the structure of 'the family' in the United States is different in different groups" and state or imply that adequate time series analyses of these factors would involve subclassifications by at least age, employment status, relief status, residence in rural or urban areas, by regions and perhaps "plane of living," by race, nativity or color (and, if possible, more adequate criteria of "minority groups") etc. Regarding crime, Sellin points out that many indexes of crime have been available in time series but that a major difficulty in analyzing the relationship between crime indexes and economic indexes is the temporal shift in the unit of recording:

The student of birth rates knows that births may not be recorded as fully during a certain period as compared with another, but he at least knows that what he does count remains unchanged in character. The unit of counting is constant. The student of crime rates, on the other hand, does not only face the need for determining the effect of changing public attitudes and administrative practices on the recording of crime data, but he finds that the definitions of specific offenses are more or less elastic, so that for one year he may have to count as larceny, for instance, some form of conduct which could not have occurred or which was not punishable in earlier years or which was labeled by some other name and therefore counted with the units of an entirely different category. The constancy of the units of offenses counted is therefore at present illusory (pp. 11-12).

His analysis further makes clear that the student of crime must also be in a position to differentiate among the various indexes of crime which are available; he must find an index which is sensitive, which is "based on offenses that are highly 'reportable' or 'detectable'" (p. 69); which is preferably for specific types of offenses; which is subclassified regionally and by social classes of the population.

In regard to measures of health, various indexes are available: "mortality, sickness, and the prevalence of physical defects including malnutrition and

underweight" (p. 11) but Collins and Tibbitts point out that mortality data, while not the most precise measure of health, provide almost the only reasonably satisfactory historical time series. These authors also indicate the necessity of specificity in the series. For example, the positive correlation between death rates and business cycles, which has been observed by a number of investigators, cannot be interpreted adequately until time series are found for

specific groups, such as deaths from specific causes at specific ages. The breakdown that suggests itself as most pertinent would be deaths from certain causes for males of working ages, say 20-64 years. While it would be desirable to have rates that were also specific for type of occupation, at least to the extent of a separate rate for the laboring classes, no accurate data are available for such statistics. Because of aging of the population, adjustment for age differences probably should be made unless the age groups include a span of not more than 20 years. It would be important to compile the statistics for certain states and large cities separately, and compare the trends in agricultural states with those in industrial states (p. 27).

Further problems in the use of time series of vital statistics, pointed out by these authors, are that deaths have not been consistently allocated to residence and that intercensal and postcensal population bases, on which these rates are computed, are subject to cyclical fluctuations which cannot, at present, be accurately estimated. The former difficulty is, of course, shared with the student of the family in his time-series of births, marriages and divorces; the latter waits for its solution upon the student of migration.

In so far as the problem of social aspects of the depression depends on historical time series analysis, then, the authors of these three monographs are in essential agreement. Little more than gross relationships can be determined with data now available for a span of years and covering an adequate number of cycles. The problem is to lay immediate plans for future time series. The essential technical points in respect to these series are: (1) constancy of the unit of measurement, (2) sensitivity of the index chosen, (3) significant subclassification, and (4) accuracy of the population base. The third of these points is made explicit in regard to another field of investigation (*Minority Peoples*) by Young, who underlines the necessity of "valid subgroup definitions" (p. 5) in reaching true generalizations about the disparities of minority population groups. Census subclassification, he points out, is oversimplified for research purposes since only foreign-born whites and their children are classified by national origins. Thus "groups characterized by distinct alien cultures and related problems of intergroup relations" (p. 4) are lost to research. Crossnational subclassification (e.g. Jews) and subnational (e.g. North Italians and South Italians) are equally important in sociological studies. Valid subclassifications of Negroes by region of origin, education, and economic status; of Indians by "tribal" and "assimilated groups," and of Japanese by "castes" are among the most elementary essentials for determining differentials.

The authors of all the monographs recognize that even with favorable future developments in data collection the continuous time series technique will be applicable to only a few aspects of their problems. They point out that a whole cluster of problems can be approached with data in the form of discontinuous time series, however, and that this approach can be so organized as to include both qualitative and quantitative items. The recommended procedure is that of repeated surveys, or censuses. Stouffer and Lazarsfeld, for example, point out the possibility of studying marital separations from census schedules. Separation would be defined in terms of spouses resident in different communities or at different addresses.

With all its defects, the statistical concept of separation presents definite research possibilities for studies in areas which took a census at some point during the depression. Let us assume that the percentages separated among all married persons were known for 1910, 1920, 1930, 1935 (or earlier depression year), and 1940 in some area (p. 75).

If such data were available, the authors further assume that a trend could be determined and that the depression deviation from this trend could be estimated. But censuses are quite fortuitously timed with respect to phases of business cycles and the accurate determination of a trend on this basis would introduce greater difficulties than they admit. According to Thorp's business annals, 1910 was a year of recession, 1920 (at the time of the census) was in the prosperous phase, and 1930 was a year of depression. Thus the probability of throwing light on recent depression phenomena with such a series is very slight. The repeated field survey affords a more elastic approach and is applicable to a wider range of problems, for the timing can be determined in accordance with comparable phases of business cycles. Even this approach, however, may introduce extraordinary difficulties, due to the unknown lengths of the time lag in the response of social phenomena to business cycles.

The difficulties suggested by this approach become minimized, however, in comparison with the difficulties faced by many of the authors in attempting to evaluate an event or combination of events unique to a single depression. The recent situation in agriculture is a case in point: the beginning of the agricultural depression antedated the industrial by almost 10 years; two unprecedented droughts were coincident with the industrial depression; and the federal government established a new series of agencies to assist agriculture. To disentangle the "social aspects of the depression" from this network of factors is a Herculean task. Sanderson, in the monograph on *Rural Life* handles the problem with skill and insight. Another similarly competent performance is the Whites' evaluation of *Relief Policies*. Certain of the other authors met with less success, particularly when dealing with a field where a phenomenon was first observed in the 1930's. In such cases, the allocation of "nonexistence" to a specific pre-depression year may be especially misleading. For example, the monograph on *Consumption* contains statements of which the following is typical: "auto radios have increased from none in 1930 to 3 million in 1936" (p. 24).

This series of monographs should be further evaluated as contributions to method. Stouffer and Lazarsfeld, on the one hand, and Donald Young, on the other, have made especially significant contributions from this point of view: the former in respect to their statement of the logical interdependence of the case and statistical methods; the latter, in his development of a methodology for approaching problems of cultural disparity.

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Statistical Methods Applied to Economics and Business (Revised), by Frederick C. Mills. New York: Henry Holt and Company. 1938. American Business Series, General Editor, Roswell C. McCrea. xix, 746 pp. \$3.75.

Fourteen years have elapsed since the first edition of Professor Mills' book appeared, and during those years it has proved to be one of the best American texts available. The author states in the preface to the revised edition that "account has been taken of the more important of the recent developments that have a bearing on the economic and business applications of statistics. In doing this I have sought to retain the main features of the first edition. A systematic development of the fundamentals of statistical method is needed by the beginning student. A working compendium of procedures, with necessary aids to calculation and reference tables, is required by the statistician engaged in administration or research. The book is designed to meet these two needs."

There are two types of textbooks, one which requires much supplementary explanation and interpretation on the part of the instructor and one which by its clearness of style, organization of material, and completeness of detail represents an intellectual entirety which results in a lasting companionship between text and student. Professor Mills' book belongs to the latter type.

Without reference to the historical development of statistical methods, the author proceeds to introduce the subject matter at once. In conformity with the purpose of the text, as outlined in the preface, it was doubtless felt that introductory chapters on "Statistical Methods and the Problems of Economics and Business" to be followed by chapters dealing with "Graphic Presentation" and the "Organization of Statistical Data," respectively, assure immediate pedagogic results. Not mentioned in the references following the chapter on Graphic Presentation is the important contribution by H. Gray Funkhouser, which appeared in *Osiris*, Bruges (Belgium), Vol. III, Part I, 1937, pp. 269-404 under the title "Historical Development of the Graphical Representation of Statistical Data."¹ Interesting comments on the significance of Funkhouser's historical study by J. M. Keynes will be found in the June, 1938, issue of the *Economic Journal*, London.

With minor changes in the text, the basic content of the first thirteen

¹ Editor's Note. See page 623 of this issue for a review of this contribution.

chapters has remained essentially the same. The changes consist on the whole of the revision of practically all charts and tables. In tradition with the first edition, tables are frequently accompanied by details of computations, an excellent technique and of great aid to the student. The summarization at the end of each chapter and the appended references are not less valuable.

The text of chapter XIV, "Statistical Induction and the Problem of Sampling," has been completely revised. Discussed here is the technique of sampling in the light of more recent developments.

The introduction to the analysis of variance in the new chapter XV of the revised edition is likely to be less readily absorbed by the student unless accompanied by discussions on fundamental concepts in the classroom. It should be remembered that at this stage of the text the student hears for the first time such terms as "degrees of freedom" and "coefficient z ," in connection with Fisher's theory of variance. He doubtless will be confused by the unceremonial introduction of these important strangers and will want to know a little more about their origin and their relationship to the older and more familiar members of the family. Fisher's theory of variance, while not accepted by all schools of methodologists as *lex terrae*, is, to say the least, subtle, both in application and in interpretation. It will appear even more so to the student who first comes in contact with it. The situation encountered here is comparable with that experienced when the subject of differential calculus is introduced to students who have been accustomed to the less sophisticated modes of algebraic operations.

It has been somewhat of a puzzle to the reviewer why, on the whole, authors of statistical texts have seen no reason to include in their texts an exposition of the theory of attributes and its expansion, similar to the first chapters of Yule and Kendall's *An Introduction to the Theory of Statistics*. This approach would furnish the student not only with an excellent discipline in logic but, most important of all, would pave the way to a better understanding of statistical induction, of the problem of sampling, and finally of the analysis of variance. Moreover, the theory of attributes and the exposition of consistence of data are concepts which, once absorbed, will guard against the commission of elementary statistical fallacies.

Chapters XVI and XVII, "The Measurement of Relationship: Multiple and Partial Correlation" and "The Measurement of Relationship and the Problem of Estimation," respectively, have remained the same in their basic structure.

Chapter XVIII, "Statistical Induction and the Problem of Sampling, Concluded" is new and includes sections which deal with small samples, the transformation of r , and the nature of Chi-Square and its distribution.

To the revised appendix, which consists of five sections, much new material has been added. Section D contains detailed instructions for computing a modified exponential curve, a Gompertz curve, and a logistic curve, all of which are valuable for reference purposes. Section E, entitled "A Further Application of Variance Analysis," is an extension of chapter XV to illustrate

by additional examples the application of Fisher's method of variance analysis.

Appendix F, "Glossary of Symbols," and ten appendix tables, five of which are excerpts from tables appearing in R. A. Fisher's *Statistical Methods for Research Workers*, a list of references, and an index conclude the book.

The new edition of Dr. Mills' book will continue to be of valuable assistance to the student who is in need of a practical reference text and of a technical introduction to the fundamental operations of statistical methods.

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A First Course in Statistics, by E. F. Lindquist. Boston: Houghton Mifflin Company. 1938. xiv, 226 pp. \$2.25.

Study Manual for A First Course in Statistics, by E. F. Lindquist. Boston: Houghton Mifflin Company. 1938. vi, 122 pp. 80 cents.

Following the current trend toward making introductory courses in educational statistics as easy as possible for those students who are not mathematically trained, the author has prepared a textbook which should accomplish this purpose to a remarkable degree. It has been designed to cover a one-semester course at undergraduate or graduate level.

An idea of the topics which are included may be gained from a list of the chapter headings, namely, "The Frequency Distribution," "Percentiles," "Graphical Representation of Frequency Distributions," "Measures of Central Tendency," "Measures of Variability," "The Normal Curve of Distribution," "Sampling Error Theory," "Standard Measures and Methods of Combining Test Scores," "Correlation Theory," and "Correlation Techniques Applied in the Evaluation of Test Materials."

The book is written in a facile style, much like a series of informal lectures. Its central theme is the use and interpretation of the various statistics, with only minor emphasis upon formulae and methods of computation. The *Study Manual* which accompanies the text should be considered a part of it. The reader is warned in a number of places that the discussion in the text is incomplete and that the questions in the *Study Manual* must be considered in order that an adequate understanding may be attained. The *Manual* is particularly valuable in this respect in connection with the chapters dealing with percentiles, graphical representation, measures of central tendency, and measures of variability. In the words of the author. "Much of what has formerly been *presented to* [the student] (for memorization) is here *drawn out* of him through leading questions and suggestive illustrations."

There are a number of minor points of criticism which might be worthy of mention. For example, the reviewer would not agree with the author that an interval of five units for a frequency distribution should have its mid-point fall on a multiple of five; on the contrary, it is far easier to tally data if the lower integral limits (as distinguished from the real limits) are always multiples of the size of the interval.

Having bent all his efforts toward making his subject comprehensible to the nonmathematical student, the author has perhaps neglected those students who might prefer to think in mathematical terms. Four pages are devoted to verbal instructions for computing percentiles and percentile ranks. Nowhere, however, does there appear a formula for either of these measures. Likewise, there are four pages of instructions for computing a mean from a frequency distribution, again with no formula.

Possibly the topic which has been least adequately treated is that of significant figures. The discussion, although lengthy, refers specifically to the number of significant digits which should be retained in the mean and fails to generalize to other situations. No instruction is given relative to the rounding of numbers. Although most of the numbers in the numerical examples throughout the book are properly rounded, some are not. On page 76 the square root of 3.998 is given as 1.99, which should have been 1.999 or 2.00, and which leads to an error of 0.05 in subsequent calculation.

The following typographical errors have been noted: page 101, the reference in line two should be "page 84"; page 120, formula (17), the σ_2 to the left of the equality sign should be written as part of the subscript; page 131, the end of the second paragraph should read "Table 19 "

The value of Dr. Lindquist's contribution lies in his clear presentation of the various statistical concepts, both in the *Manual*, as noted above, and in the text, particularly the normal curve and correlation theory. The text could hardly serve as a reference book and should not be employed without the *Manual*. The latter, on the other hand, could be used to advantage with any textbook in educational statistics.

FRANCES SWINEFORD

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Tests of Normality, By R. C. Geary and E. S. Pearson. England: Issued by the *Biometrika* Office, University College, London, and printed at the University Press, Cambridge. 1938. 15 pp. One shilling.

Although for large samples the β_1 and β_2 tests of the normality of distributions have long been among the tools of statisticians, it is only during the past ten years that progress has been made in deriving the exact sampling distributions of the usual estimates b_1 and b_2 of β_1 and β_2 , respectively. In these few pages, which are, perhaps, best regarded as a separately issued chapter of an elementary textbook on statistical methods, the authors present results obtained in previously published research on the exact sampling distributions of b_1 , b_2 , and a , where a is the average deviation divided by the standard deviation. The statistic a has been introduced as a possible substitute for b_2 , since the sampling distribution of the latter is too skew for easy use and since the fact that a and b_2 have a high negative correlation makes it possible to consider a to be a measure of kurtosis. Examples dealing with grouped and ungrouped data are worked out in detail. Computing charts which greatly reduce the necessary work are included.

The monograph is clearly and nonmathematically written. References are given to the theoretical research on which it is based. It makes available, for routine computation, statistical methods which, in that they are easy to use and are valid for samples of any size, are superior to the techniques now commonly employed for the same purpose.

WILLIAM G. MADOW

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Historical Development of the Graphical Representation of Statistical Data, by H. Gray Funkhouser. Bruges, Belgium. Saint Catherine Press Ltd. *Osiris*, Studies on the History and Philosophy of Science, and on the History of Learning and Culture, Edited by George Sarton. Volume III, Part I. 1937. pp. 269-404.

The story of how graphic methods came into being should prove interesting reading to all statisticians. Dr. Funkhouser's recent work represents the first serious attempt to trace the development of the graphic method from its early beginnings. No doubt to most readers it will be a surprise to learn that excellent charts were being made over a century and a half ago.

Dr. Funkhouser has dug deep into the records of the past to find examples of graphic devices used to present statistical information. He traces the elements of the modern chart back to very early times. The principle of co-ordinates he places in Egypt and Greece long before the time of Christ. He has discovered a representation resembling a modern chart in a tenth century Latin treatise on astronomy. The concept of presenting theoretical data graphically seems to have been developed by the French mathematician Oresme in the fourteenth century, although the first example located by the author of the presentation of observed data in graphic form was a drawing of the variations of the compass prepared in 1701 by the English scientist Halley. The first published instance of the practice of representing time as a line appears in a treatise prepared in the middle of the eighteenth century by Joseph Priestly, the English chemist. Dr. Funkhouser refers to the contributions of many other scientists during this early period, but it is to William Playfair that he gives most of the credit for originating charts such as we know today. Certainly the charts included in the treatise, some of them originally published as early as 1786, are surprisingly modern in their general appearance and conform in most fundamental respects to the best practice today.

Some of the most interesting material contained in Dr. Funkhouser's work has to do with the history of attempts to standardize graphic methods. In connection with the meetings of the International Statistical Congresses held in Europe between the years 1853 and 1876, the graphic method became the subject of much discussion, particularly as regards the possibility of making it an international language in the scientific field. Dr. Funkhouser

devotes considerable space to the arguments for and against standardization voiced during this period, but unfortunately he does not carry the story through to the present time. The standardization movement in the United States during recent years he dismisses with a very few words. He does mention the Joint Committee on Standards for Graphic Presentation, formed under the sponsorship of the American Society of Mechanical Engineers in 1913, and refers to the preliminary report the Committee published in 1914, but then he makes the statement that "nothing further than the issuance of the foregoing preliminary report seems to have been done by this Joint Committee." As a matter of fact, this committee worked for several years after this on the compilation of recommendations as to graphic principles and procedures and the committee was, in effect, revived in 1926 when the American Society of Mechanical Engineers formed a joint committee of representatives of national societies, known as the Sectional Committee on Standards for Graphic Presentation, a committee that is still active.

The part of the history having to do with the application of the graphic method during the past 30 or 40 years seems quite inadequate. Apparently no serious attempt was made to cover all the fields in which the method has come to be used, and no mention is made of the multitude of charts and diagrams being prepared for purposes other than publication, for example, charts prepared for administrative use in the business and industrial fields where, during the past twenty years, the graphic method has become a generally accepted tool of management. Dr Funkhouser probably should not be criticized too severely, however, for the omission of unpublished material, for any thorough-going survey of all applications of the method would be a sizable undertaking indeed.

The reference value of the treatise has been considerably enhanced by the inclusion of an excellent annotated bibliography of some twenty pages, listing American and foreign publications relating to the subject of graphic presentation or including examples of the method. On the whole, statisticians should be grateful to Dr. Funkhouser for the material he has assembled, particularly that culled from early sources which provides a wealth of evidence that the graphic method has had a worthy ancestry.

A. H. RICHARDSON

New York, N. Y.

Kapitalexport und Schuldentransfer im Kontjunkturverlauf, by Dr. Peterheinz Werhahn. Jena, Germany: Verlag von Gustav Fischer. Probleme der Weltwirtschaft. Schriften des Instituts für Weltwirtschaft an der Universität Kiel. Herausgegeben von Prof. Dr. Andreas Predohl, 60. 1937. viii, 186 pp. RM 9.—

This book offers a survey and an analysis of the statistics of the balance of payments of many countries during the postwar period and especially in the depression years. It departs in two directions from the traditional ap-

proach. By theoretical reasoning and factual analysis it substantiates arguments which have been proposed as a criticism of orthodox theories on the one hand and of a merely statistical interpretation on the other hand.

The orthodox theory of international capital transactions described the mechanism by which a transfer of money from one country to another country leads eventually to a corresponding movement of merchandises by which the monetary transfer becomes a real one. Werhahn distinguishes the transfer of capital from the transfer of interest. The transfer of capital usually will not meet difficulties. The fact that borrowers succeed in meeting capital demand often creates conditions through which the transfer can be realized. There will be usually a demand for capital in a country only when the general business conditions are favorable, and then there probably will be little difficulty in executing the transfer.

The case of a transfer of interest payments from a debtor country to a creditor country is different. As long as these payments are compensated by capital transactions in the other direction the difficulties often will not become apparent. When in a depression, however, the capital movement stops, a real problem may arise, and it will be aggravated when the prices are declining while the nominal amounts of the interest charges remain the same. A transfer in gold will not induce the central bank in the creditor country to expand the volume of credit and to raise the price level (as it should be expected, according to the orthodox theory). The attempt of the debtor country to enforce exports will not meet an expanding demand in the creditor country. The producers of the latter country will request a protective trade policy against the competitor. The debtor country then will resort to a restriction of imports in order to establish the export surplus which is necessary for the transfer of the payments. This restriction will result in a further contraction of purchasing power in other countries. Moratoria for international debt services will result, often only after the attempt to enforce the transfer has contributed to an aggravation of the depression. This picture certainly is quite different from the one sketched by John Stuart Mill and his successors. Recent experience has proven that under certain conditions and in certain phases of the business cycle such a pessimistic theory is more realistic than the orthodox theory.

For a merely statistical interpretation of the balance of payments the various amounts are nothing but items in an equation. A merely statistical analysis cannot establish any causal relationship among various items. The author applies a classification of the various items according to the *autonomous* changes which result from events outside of the balance of payments and the *reactive* changes by which a change in other items is compensated. If, for instance, an increase in imports is financed by short-term borrowing, this capital import is regarded as a reactive change compensating the autonomous change which occurred in the imports of the country. This analysis leads to a dynamic interpretation of the balance of payments.

In the statistical interpretation of the balance of payments mostly net figures of the balance of capital and interest payments are compared with

the net balance of trade and services. The author finds cases in which, for instance, an import of capital and a payment of interest compensate each other so that no influence is exerted upon the trade (for instance in the post-war conditions of the South American debtor countries). In other cases he finds, however, that the capital import is realized by an import of machinery and other industrial equipment, whereas the interest payments are executed by an export of raw materials. Under such conditions—the author gives the Eastern and Southern European countries as examples—the effects of capital import and interest payment do not offset each other, but each one affects the balance of trade, the one the import, the other the export side.

I report in some detail on these points of view which the author takes in his analysis, since I regard them as an improvement compared with the traditional approach. These points of view were, of course, not originated by the author, but he uses them successfully in the analysis of a rich statistical material.

GERHARD COLM

New School for Social Research

The New York Bond Market 1920-1930, by Charles Cortez Abbott. Cambridge, Massachusetts: Harvard University Press 1937. Harvard Economic Studies, Volume LIX. xvii, 224 pp. \$2.50.

In the introductory chapter, the author states that the study was initially undertaken in the statistical department of the National City Company. In its original form it was essentially an analysis of "contemporary happenings." Its primary purpose was to "throw some light on those deep-lying economic forces which determine the success or failure of new security issues." Subsequently the scope was enlarged to include an analysis of the relationships of the banking system to the capital markets in the period covered and an evaluation, through the use of statistical data, of the monetary theory then current, by which the author apparently means the doctrines set forth by Professor Keynes in his *Treatise on Money*.

The study opens with a description of the characteristics and peculiarities of the bond market. Emphasis is given its importances in the economic life of the country. The various sources of demand for bond investments as well as the changes that occur through time in the quality of bonds are analyzed. Attention is directed to the important interactions between short- and long-term rates of interest.

Following upon this general discussion of the characteristics and problems of the bond market, there is presented a complete statistical review of developments from 1920-1930. Data are included of prices, yields, the volume of trading, the volume of gross and net bond issues, etc., and estimates are presented of the year-to-year changes in the bond holdings of various classes of investors. This period is then divided into six separate segments, with a

chapter devoted to a detailed treatment of each. The author's significant conclusions and interpretations are summarized in the final chapter. Supporting statistical data are presented in appendices; and a bibliography, with reference to the pertinent works in the field, is included.

One of the conclusions reached by the author in consequence of his studies is that the volume of bond flotations is more influenced by the current price of capital than by the needs of industry for long-term funds (pp. 21-22). It must not be assumed from this statement that easy credit conditions are always the controlling factor. In 1921, the desire of business concerns to refund bank loans led to bond issues at a time when money rates were high (p. 74). In general, however, "the amount of capital sought at any given time through bond issues is ordinarily affected to a very high degree by the relative cheapness or dearness of borrowing" (p. 19). To this statement should be added the important qualification that its correctness depends upon an absence of change in entrepreneurial expectations at different points of time.

Bank buying, representing the principal demand for long-term bonds, is not in itself influenced by the long-term rate of interest. Whether commercial banks purchase bonds or not depends upon the amount of their excess reserves. Through this period excess reserves to a large extent were a function of the open-market operations of the Federal Reserve banks. The consequence was that when the Federal Reserve banks were adding to their open-market portfolios, member bank excess reserves were large and the bond market was buoyant. Bank credit rather than savings equated the demand for and the supply of capital issues.

A development, to which the author gives repeated emphasis, was the loss of relationship between short- and long-term rates of interest. Through much of the period studied, the two proceeded along different courses (pp. 145-48). In the five years from 1923-1928, movements of short-term rates had little effect upon movements of long-term rates (p. 100). A diversity of this character, Professor Abbott declares, "can be taken as evidence that the financial mechanism is subject to unusual influences" (p. 145).

In consequence of his studies, the author is not one to adhere to the oft-expressed notion that the Great Depression was the result of oversaving and of underconsumption and that the remedy lay in increasing the volume of monetary purchasing power. In his opinion, investment outran savings in the decade of the twenties (pp. 150-51).

Through the volume, pains are taken to analyze carefully the reasons for and the economic implications arising from the growth in funded debt. The effect on the banks through the alteration in the character of their assets, the effect on the public, and the effect on cost rigidities of business are discussed.

The volume may be characterized as a discussion of the bond market from the money market point of view. The analysis, as the author states himself, is in terms of short-time periods. Interpretations proceed from an analysis of the supply of and demand for reserve funds. In consequence the volume

supplements those studies which approached the subject from a more abstract standpoint and is a valuable addition to the growing literature on savings and investment.

BENJAMIN HAGGOTT BECKHART

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Financial Development of the United States, by William J. Shultz and M. R. Caine. New York: Prentice-Hall, Inc. 1937. xxviii, 757 pp. \$5 00.

Financial histories all too often have been concerned mainly, if not exclusively, with government finance and with monetary and banking developments. The authors of this volume have sought to include various other phases of private finance as well in writing a financial history of this country from colonial days to the end of the first administration of Franklin D. Roosevelt.

The chief problem that arises in such an ambitious undertaking is to redefine the scope of the field. In their introduction the authors unhappily define finance as "all factors involved in transactions in values," which of course far transcends the ground they cover. Actually they seek to integrate available historical material on government finance, money and banking, the development of the capital market, and corporate combinations. The evolution of corporate accounting practices, stock exchange methods, consumer finance, and certain other phases of financial evolution are touched upon little, if at all.

A second basic problem confronting the authors was to mark off the various epochs of financial development. They chose to distinguish fully 20 separate periods from 1600 to 1936, and to treat each era distinctly. Although this procedure has enabled them to compress a vast amount of factual material into their book, it has tended to hamper broader analysis and the study of the interrelation of the major forces which shaped financial development.

The result is a readable and interesting narrative which should prove of special value to students of finance who have found the available historical literature concerned either with economic development in general or with particular phases or periods of finance.

JULES I. BOGEN

The Journal of Commerce
New York City

Studies in Income and Wealth, Volume One, by the Conference on Research in National Income and Wealth. New York: National Bureau of Economic Research. 1937. xviii, 348 pp. \$2.50.

The meeting sponsored by the conference, and here reported, was a co-operative venture by several universities and economic research organizations, in an attempt to lay the conceptual foundations for later statistical

research in national income and wealth. The various controversies concerning national income which have enlivened the dinner hours in economic research bureaus for almost 20 years are here put in print for a wider audience, and the result is a contribution to economic and statistical thinking.

The report contains papers on the general question of the definition of national income, written by some of the men most interested in national income estimation, namely, M. A. Copeland, Simon Kuznets, and Clark Warburton. It proceeds from these general definitions to their accounting and taxation aspects, discussed by some of the above-named men and by specialists such as Solomon Fabricant, Gerhard Colm, Carl Shoup, Mabel Newcomer, and Boy Blough. The final parts are papers on labor income by Solomon Kuznets and on income parity for agriculture by O. C. Stine.

Most of the puzzles which have confronted statisticians in this field are mentioned, such as the imputed income of housewives and of home owners, government income and interest on government bonds, relief and subsidy payments, general price level changes, accrued versus received bases of computation, capital gains, entrepreneurial withdrawals, and international payments. These items are treated variously according to each writer's preconceptions, and some light is thrown on the nature of these preconceptions. Some agreement is reached, mainly on the thesis that there are between three and five different types of measurement of national income, but no agreement on the question whether all types would, with complete measurement, reach the same total. In particular, it is pointed out that the most common definition of national income, namely, a flow of goods and services, is almost never used in actual measurement.

That this discussion did not succeed in getting down to the fundamental conceptual difficulties is a reflection not upon the eminent participants but upon the state of modern economic thought. Still dominated as it is by the Ricardian cost concept of value, despite minor concessions to the Austrian school and a nod to the institutionalists, and still strongly materialistic, economic theory today offers little except handicap to the statistician. Accounting theory and practice, in so far as it is also dominated by the cost concept of valuation, is a further handicap. This book reveals rather than satisfies the need for some heavy thinking on the nature of income and wealth.

Ethical preconceptions, ranging from the "productivity criterion" of income to the rejection of products not considered socially acceptable, are apparent throughout the discussion, and are openly acknowledged by some of the writers. In arriving at net income, the cost of keeping a horse is always subtracted from the gross income of his services, but the minimum cost of keeping a man is never subtracted from the gross income of his services, perhaps, as Irving Fisher once said, because to do so would reveal certain classes of people to be receiving no net income! Attitudes toward the spread of government activities and toward relief and agricultural subsidy payments may or may not influence the decision whether to include such items in the national income.

Progress seems to have been made in these papers toward distinguishing between the "flow of goods and services" and the concept of "available" or "disposable" money income. The difference between these concepts, when unrecognized, has always confused discussion. If the idea that money means more than the purchase of materialistic goods and services, that it means also prestige, power, security, and other intangible elements whose ultimate translation into goods and services is remote or improbable (an idea partly suggested by Clark Warburton's paper and partly implied there), ever is accepted, the reconstruction not only of the statistical but of the economic theory of income will have begun.

Attention perhaps should be called to the paper on corporate savings by Solomon Fabricant, the algebraic treatment on intra-year price changes and their effect on inventory valuation by Simon Kuznets, and the fine illustrations of the influence of accounting methods on income totals by Clark Warburton, as special contributions of interest. In general, the book will be a stimulant to thinking for many years.

EDGAR Z. PALMER

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National Income and Capital Formation 1919-1935, by Simon Kuznets. New York. National Bureau of Economic Research. Publication Number 32. 1937. x, 86, pp. \$1.50.

This volume is a preliminary summary report of two studies—one of national income and the other of capital formation—carried on during the past four years by the National Bureau of Economic Research under Dr. Kuznets' direction. Some material from another study of the National Bureau—that of capital consumption under the direction of Mr. Solomon Fabricant—has also been incorporated. Since the full report of none of the three studies has yet been published, and details regarding sources and methodology are omitted from this summary volume, no general appraisal can be made in this review of the methodology employed nor of the validity of the estimates. The review is, therefore, confined to the concepts selected by Dr. Kuznets for statistical measurement, some of the basic procedures in preparing the estimates, and a few of the most important results.

Dr. Kuznets retains the definition of national income which has long been used by national income investigators in the United States but has dropped the term "national income produced" which was used in some of his former publications to designate this concept. He states this definition as follows:

Net national product or national income may be defined as the net value of commodities and services produced by the nation's economic system. It is "net" in that the value of output of all commodities and services is reduced by the value of commodities (fuel, raw materials, and capital equipment) consumed in the process of production.

Dr. Kuznets' measurements cover not only national income but also gross national product, which includes, in addition to the items making up the

national income, the value of durable capital goods used up—that is, the amount of depreciation and depletion—in the process of production. He points out that the value of the national product, whether gross or net, may be measured at any stage in the circulation of economic goods—production, distribution, or consumption—with results that should be identical, provided statistical data are adequate; but that judgments as to what constitutes economic activity, and judgments as to what constitutes commodities and services, income shares, consumption, savings, etc., are of telling importance in the measurement of the value of the national product.

With Dr. Kuznets' definition of national income, and with the foregoing general observations regarding national income measurements, other economists, are, so far as the reviewer is aware, in full agreement. But Dr. Kuznets' use of the two terms "net national product" and "national income" as identical, his assertions regarding basic procedure in preparing national income estimates, his judgments regarding what commodities and services are properly included in the product of the nation's economic system, and his methods of evaluating some of these commodities and services, will not be so uniformly accepted.

In a footnote Dr. Kuznets remarks: "we conceive national product properly as a sum of values rather than identify it improperly with a congeries of specific commodities and services." To the reviewer it seems an exceedingly unfortunate use of language to apply two terms synonymously to one concept and to deprive thereby another equally important concept with an especially descriptive and apt term. It is preferable to use the term "national product" to designate the congeries of specific commodities and services resulting from economic activity, and the term "national income" or "value of the national product" to designate the sum of the values of those commodities and services.

Dr. Kuznets' explanations of his basic procedure in preparing estimates of the national income are ambiguous, if not in fact contradictory. In one place he states: "whatever results of economic activities were included in the national product totals were assigned the value they brought on the market." In this statement the pronoun "they" presumably refers back to the word "results"—implying that the final sale values of consumers' commodities and services, and of new capital items, were estimated and summed to obtain the value of the national product. In another place Dr. Kuznets states that the available data render it necessary to estimate national income by the procedure of aggregating the incomes paid to individuals plus net savings of all business enterprises. As a matter of fact, Dr. Kuznets uses only the second of these two in estimating the total national income, but he also uses the first method in estimating the value of capital items and of consumers' commodities. By this combination of methods he obtains an evaluation of consumers' services not embodied in commodities as a residual difference between the total value of the national product and the value of that part of the product which consists of commodities.

It is greatly to be regretted that Dr. Kuznets did not follow both methods,

keeping them as independent of each other as possible and comparing the results. His assertion that the available data require the use of the second method in estimating the total national income is sheer nonsense. Data regarding the value of consumers' services not embodied in commodities are as plentiful and as reliable as those regarding "entrepreneurial withdrawals," "net savings" of unincorporated business enterprises, or wages and salaries in some industries.

With reference to the character of the individual and social activities which are included in the "nation's economic system," Dr. Kuznets states:

It (national income) refers, by design, to the net product of the economic system, which, for economically advanced nations of recent times, may be treated as identical with the market economy. If "market" is understood broadly as the meeting place of all buyers and sellers, no matter how greatly freedom of transactions may be curbed by custom or by regulation, then national income measures the net product of activities connected through the market, and excludes the results of other activities that may supply utilities but are outside the market mechanism.

Dr. Kuznets, however, does not adhere strictly to this position, and it may be suggested that he would have expressed his own position more accurately had he been less categorical in his statement regarding the identity of the market economy and the economic system. In fact, Dr. Kuznets makes several important departures from this assumption in his estimates of national income. These departures, as stated by himself, are as follows.

There are a few types of income that do not pass through the market and do not find their equivalent in the sphere of monetary circulation, but that should nevertheless be included as representing the result of economic activity: (1) the share of the product retained by entrepreneurs for their own consumption (largely on farms); (2) payments in kind to employees (a practice especially important in compensating farm laborers, domestic servants, steamer crews, etc.); (3) services of houses inhabited by their owners.

However, not all compensation to individuals for marketable activities is included. . . . In general, the national product totals presented below exclude the returns from three sources: (1) activities that have been explicitly recognized by society at large, overtly in the form of legal prohibition, not only as unproductive but also as distinctly harmful: theft, robbery, prostitution, murder, smuggling, counterfeiting, forgery, drug peddling; (2) activities that while legal, represent largely shifts of income among individuals rather than additions to the command over goods: gambling profits and speculative gains from the sale of assets by non-professional groups that can in no way be interpreted as resulting from skill in the performance of any useful functions that speculative markets may be presumed to render; (3) gains and losses that result from a mere change in the price level, on the same grounds that apply to the exclusion of speculative gains resulting from professional activity.

Dr. Kuznets also includes in the national product one important group of services not specified in this quotation which are likewise not distributed

through the market economy, namely, those furnished by governments to individuals without specific charges.

The reviewer concurs with Dr. Kuznets as to the necessity of making some departures from the assumption that the economic system is identical with the market economy. In at least two respects, however, Dr. Kuznets' procedure in making such departures is such as to produce serious doubts about the year-to-year comparability of his estimates of national income. (1) If Dr. Kuznets has, as he states, actually excluded the returns or income derived from activities legally prohibited, then his estimates for the years 1933-35 are raised by several per cent, as compared with those for preceding years, just because of the repeal of the 18th Amendment and of accompanying State laws, in addition to whatever differences result from changes in prices and consumption of alcoholic beverages or from changes in the earnings of persons engaged in their production and sale. (2) Dr. Kuznets has valued governmental services rendered to individuals by the amount of direct taxes paid by persons out of their individual incomes. (See *Studies in Income and Wealth*, Vol. I, p. 237. Dr. Kuznets does not explain in *National Income and Capital Formation*, except by inference, how he handled such services.) Because of the marked differences between the yearly variations in such taxes on the one hand and the yearly variations in the volume and cost of Government services on the other, and the fact that Dr. Kuznets does not allow for such variations in his indexes of retail prices, serious distortions occur in the comparability of Dr. Kuznets' annual totals, particularly those given in "constant" or "deflated" prices.

In view of the growing importance of governmental services and of the extent to which these services are financed by indirect taxation, and of the complexity of the problem of treating them in national income measurements, it is perhaps desirable to illustrate by a simple example the nature of the distortion produced by Dr. Kuznets' procedure. Suppose that some branch of the cosmetics industry has in one year an output of 60,000 units which are sold at a market price of \$5 each, that no taxes of any kind are paid by this industry, and that the entire proceeds from the sale of the product are paid out in some form of individual income. Suppose that in the next year a tax amounting to \$1 per unit is levied on the industry, the proceeds of which are used to pay the salaries of additional teachers in the public schools. Consider the following three extreme cases with respect to the effect of the tax upon sales and upon individual income and note how estimates of national income are affected thereby.

Case I. Market price of \$5 per unit is maintained, sales are unchanged, but proceeds from sales distributed to individuals are reduced by the amount of the tax.

Case II. Tax is wholly passed on to consumers by advancing the market price to \$6 per unit, and the amount of proceeds from sales distributed to individuals remains unchanged.

Case III. Market price is advanced to \$6, sales are maintained in dollar amount but drop in physical volume from 60,000 to 50,000 units. Since taxes absorb \$1

per unit, individual income drawn from the industry is reduced from \$300,000 to \$250,000.

The results of the imposition of this indirect tax, using Kuznets' procedure, are shown in the table below. Since national income in "constant" prices is in essence merely a device for deriving an index of production of the commodities and services constituting the net national product, the last column of the table reduces income in "constant" prices to such an index.

	Income derived from (in Kuznets' language, "originating in") the specified parts of		Total income from these activities in current prices	Index of retail prices	Total income in constant prices	Index of pro- duction
	Cosmetic industry	Govern- ment				
Case I:						
Prior to tax	\$300,000	—	\$300,000	100	\$300,000	100
After tax	240,000	\$60,000	300,000	100	300,000	100
Case II:						
Prior to tax	300,000	—	300,000	100	300,000	100
After tax	300,000	60,000	360,000	120	300,000	100
Case III:						
Prior to tax	300,000	—	300,000	100	300,000	100
After tax	250,000	50,000	300,000	120	250,000	83

A method which shows income in constant prices, or an index of production, to be unchanged when educational services are increased without impairment of other output (Cases I and II) and which shows income in constant prices to have declined when the real change was a shift from one kind of product to another (Case III) is a method which the reviewer finds it difficult to commend.

Another aspect of Dr. Kuznets' treatment of governmental services, that of handling government deficits, produces astounding fluctuations in his estimates of the segment of the value of the national product originating in government. He estimates, for example, that \$923 million of income was derived from government in 1919 and \$6,906 million in 1920. In 1930 and in 1932 the amounts were \$8,184 million and \$5,859 million respectively. These amounts are presumed to include not only the value of services rendered to individuals (assumed to equal the amount of direct taxes paid) but also the value of services rendered by governments to business enterprises and embodied in the prices of the products of such enterprises and, in addition, the value of accretions to the assets of governments. How all governmental services could reasonably be valued as worth seven times as much in 1920 as in 1919—or valued in 1932 at less than three-fourths of what they were worth in 1930, in view of the very slight reduction, if any, in their volume and cost—is to the reviewer quite inexplicable.

The explanation of Dr. Kuznets' curious evaluation of income originating in governmental activity is the fact that he has treated a government deficit

as identical in character with a definitely ascertained loss by a business enterprise. Is not, however, a government deficit more closely analogous to goods sold on credit? If a government borrows money in order to finance services to its "customers," with an acknowledged and legally enforceable obligation upon the buyers (taxpayers) to pay at some future date—is not this essentially similar to a merchant who borrows from his bank in order to finance accounts receivable? Perhaps Dr. Kuznets is anticipating a repudiation of obligations by taxpayers and is consequently treating those obligations as bad debts to be written off at once.

Having used the dubious criterion of "cash" versus "credit" sales (that is, tax collections versus borrowings) as an element in the estimation of the "market value" of governmental services in current prices, and obtaining thereby an annual series of figures showing curious fluctuations, Dr. Kuznets proceeds to convert the income totals in which they are included into income at "constant" (1929) prices by applying the Bureau of Labor Statistics' index of wage-earners' cost of living. The significance of this deflated series is entirely beyond the comprehension of the reviewer.

Dr. Kuznets' method of handling the evaluation of changes in inventories will probably also provoke considerable discussion among economists working in the field of national income, for this problem, like that of the evaluation of governmental services, is highly controversial. The reviewer does not feel competent to comment upon Dr. Kuznets' procedure in dealing with this problem.

The segments of the national income regarding which Dr. Kuznets' procedure is of doubtful validity are important. They constitute, however, only a minor part of the total income of the nation, and for this reason the figures Dr. Kuznets presents probably show more accurately than any series of figures previously available the year-to-year changes in the value of the gross and net national product during the period 1919–35.

The chief value of national income estimates, apart from their use as an index of physical production of all commodities and services during successive time periods, lies in the relative importance of the various component parts and in the relative changes from year to year in the values of these component parts. Dr. Kuznets presents three classifications of such component parts, namely: (1) industrial origin, (2) type of income, and (3) character of consumers' outlay and of capital formation. He also gives a classification of type of income by industrial source. The categories used in the three classifications, with slight rearrangements made by the reviewer, together with average percentages of the value of the net national product during the entire period 1919–35, are shown on the following page.

The value of durable capital goods consumed in the process of production amounted, for the entire period, to 13.5 per cent of the national income, so that the value of the gross national product exceeded by this percentage the value of the net national product. Only 38 per cent of the value of gross capital formation—including all construction and durable producers' commodities, and all changes in business inventories, stocks of silver and gold,

Industrial origin		Type of income	Consumers' outlay and capital formation	
<i>Commodity-producing industries—total</i>		<i>Employees' compensation—total</i>	<i>Consumers' outlay—total</i>	
37 1		69 4	91.7	
Agriculture 9 7		Wages and salaries 69 2	Perishable commodities 37.0	
Mining 2 4		Relief, pensions, and compensation for in-	Semidurable commodities 15 8	
Manufacturing 21 8		injuries 0 2	Consumers durable commodities 10 8	
Construction 3 2			Services not embodied in new commodities 28.1	
<i>Commodity-handling industries—total</i>		<i>Entrepreneurial and property income payments—total</i>	<i>Net capital formation—total</i>	
24 0		29 7	8 3	
Transportation 7 6		Withdrawals by entrepreneurs 12 1	Business 3 6	
Light, power, and communication 2 7		Rents 4 6	Residential construction 0 8	
Trade 13 7		Dividends 5 8	Public agencies 3 2	
<i>Service industries—total</i>		Interest 7 0	Net change in claims against foreign countries 0 7	
38 1		Net balance of international payments 0 2		
Banking and insurance 2 7		<i>Not distributed to individuals—total</i>		
Real estate 7 9		0 9		
Government 10 9		Business enterprises 0 4		
Service 13 1		Government 0 5		
Miscellaneous 3 5				
<i>Unallocated adjustments</i>				
0 8				

and claims against foreign countries—represented net capital formation. Over 60 per cent represented replacements of structures and durable goods which depreciated or were entirely used up in the process of production.

Some of the more important conclusions which may be drawn from the classified estimates for the various years are as follows.

1. The percentages of national income derived from the commodity-producing and commodity-handling industries declined substantially during the period 1919–35, while the percentage derived from the industries producing services not embodied in commodities increased greatly.

2. The percentage of the national income received by individuals in the form of employees' compensation increased somewhat, while the percentage received in the form of entrepreneurial and property income payments, and also the percentage not distributed to individuals, declined.

3. Net capital formation averaged over 12 per cent of national income during the period 1919–29. During the years 1930–35, however, this figure was negative.

4. Consumers' outlay for durable and semidurable commodities decreased in relative importance during the latter part of the period. Outlay for services not embodied in commodities presumably increased in relative importance, but the derivation of the value of such services as a residual, together with the method of evaluation of governmental services, makes any conclusion regarding their value extremely hazardous.

Since *National Income and Capital Formation 1919–1935* is a summary volume, with details of methodology and sources of data omitted, its purpose is presumably that of presenting the conclusions of elaborate economic investigations to economists, government officials, legislators, educators, business men, and other interested persons among the general public. For this purpose the book has several serious defects. (1) The general arrangement and order of presentation of the material, although logical, is such as to be extremely confusing to all readers except possibly a few dozen specialists in the

field. Readers are plunged immediately into a technical and abstruse discussion of definitions and terminology. Most of them will reach the first table, showing yearly totals of the value of the gross and net national product, with a very confused impression of what the figures represent. (2) Long paragraphs, in which conclusions drawn from the estimates are mixed with technical explanations of procedure, make reading a tiresome and tedious task. (3) Some of the terminology is inept, and important statements are sometimes inaccurate or ambiguous. Two examples, other than those previously mentioned, may be cited. The terms, "net savings of business enterprises" and "net savings of governments" are used to designate income not distributed to owners or employees; "undistributed income" or "undistributed earnings" would be more accurate and less confusing in view of the numerous ways in which the word "savings" is already used. In the statement "a large share of total national income arises from activities that do not constitute either production or handling of new commodities; on the average, these account together for slightly over 61 per cent of national income," the antecedent of the pronoun *these* has been confused; comparison with the tables shows the correct percentage to be 39. (3) Some of the innovations in printing style, particularly the absence of indentations in the run-over lines of tables and in footnote paragraphing, needlessly enhance the strain on the eyes.

CLARK WARBURTON

Washington, D. C.

The Floating Debt of the Federal Government, 1919-1936, by Edward Raguet Van Sant. Baltimore, Maryland. The Johns Hopkins Press. 1937. The Johns Hopkins University Studies in Historical and Political Science. Series LV. Number 4. xiv, 88 pp. \$1.00.

This monograph offers a brief history of the experience of the United State Treasury with short term securities from the close of the World War to the end of the fiscal year, 1936, with an illuminating discussion of the effects of such operations on the money market and banking system. The dangers which governments must face if they finance their credit needs through increases in the floating debt have been treated with considerable clarity and restraint. The author's conclusions are not without point in a period such as the present when the amount of United States Treasury obligations maturing within six years is larger than the total debt at the close of 1930.

MURRAY SHIELDS

Irving Trust Company

Trends in Relief Expenditures, 1910-1935, by Anne E. Geddes. Washington, D.C.: Division of Social Research, Works Progress Administration. 1937. Research Monograph X. xvii, 117 pp.

This monograph contains heretofore unassembled data about relief expenditures in the United States prior to the time the Federal Government

began to concern itself with relief statistics. Information collected by the United States Children's Bureau since 1929 and by the Federal Emergency Relief Administration in 1933, 1934, and 1935 is discussed in the light of this earlier material. Conclusions believed to be implicit in the data have been indicated.

Data about relief expenditures before 1929 are rare. The available information has been widely scattered in fragments of varying significance. The legal fiction that relief was a matter of local concern deterred the systematic collection of statistics about relief on a state or national basis. The fallacy that depression "emergency relief" was unrelated to earlier "poor relief" and the high pressure under which emergency relief agencies operated prevented the majority of administrators from searching archives and ledgers to compile such data *ex post facto*. Elsewhere the casualness with which some communities had accounted for public assistance expenditures made such searches worthless. Now, however, the premise from which this monograph proceeds is all but universally recognized, that "emergency relief operations . . . can be viewed in proper perspective only against a background of previous relief experience in the United States."

The method used in this study to provide such a background was to collect as many reliable fragments of information about predepression relief expenditures as could be located. Each fragment was analyzed as an entity. The results of these analyses were then assembled in order that the experience so indicated could be compared.

Some of the fragments are sizable. Data indicating the annual expenditures of New York State and for New York City were available for each year from 1910 through 1934. Similar data were available for Indiana. In addition, there were data for New Haven, Conn., from 1910 through 1925. From the Census Bureau's *Financial Statistics of Cities* it was possible to ascertain the expenditures of a representative group of 16 key cities, in the occasional years between 1910 and 1935 for which these reports were compiled. The findings of a number of experiments in the uniform reporting of social statistics were also utilized. Since 1929, the uniform registration of social statistics by the United States Children's Bureau has provided a picture of relief operations in 120 more or less representative urban areas. For 1933, 1934, and 1935, the reports made to the Federal Emergency Relief Administration furnish almost complete material on both urban and rural relief expenditures.

What may perhaps be called the core of the monograph is the chart on page 46, "Trends of Expenditures for Public Outdoor Relief in Selected Areas, 1910-1935." In this chart, the evidence derived from each of the statistical series previously discussed in the text has been plotted in comparable terms. The similarity of experience thus revealed provides a more than adequate foundation for the conclusions to which the study points.

These conclusions, phrased in unassuming and carefully qualified language, seem to revolve around this major point, that at least since 1910 there has been a strong underlying upward trend in relief expenditures. The

precipitous increase since the depression has been but a sharp acceleration of a tendency manifest through the two preceding decades. In these decades, in urban areas if not generally, the rate of increase in relief expenditures exceeded the rates of increase in population growth and in the cost of general government. The enactment of legislation to provide special treatment of certain classes of dependent persons apart from the mass of the relief population widened the base of governmental responsibility to include state and later Federal participation but failed to arrest the increase in the cost of the residual relief functions left with the traditional poor law authorities.

The study is most modest. It does not place any more strain on the data than they can plainly support. It might be possible to argue that it errs on the side of understatement. Yet this understatement is intentional, and the study itself points to many if not all the phases of the data where this is done. In the absence of data on the trends in the size of the relief population, the monograph refuses to comment on the reasons for the increasing relief expenditures in times of apparent national prosperity. The study properly avoids any suggestion that even a jerry-built estimate of national aggregate relief expenditures from 1910 on might be made from the material used to point out probable trends. The rigid discipline by which interpretation is held to a conservative minimum enhances the reader's confidence in the strength of the monograph as an account of trends in relief expenditures during the years with which it deals.

And no thoughtful person, statistician or layman, can leave the monograph without feeling grave concern over the evidence it presents that during the nation's era of most lavish prosperity, relief expenditures were climbing with ominous celerity.

DOUGLAS H. MACNEIL

East Orange, New Jersey

The Chain Store Problem, by Theodore N. Beckman and Herman C. Nolen.
New York and London: McGraw-Hill Book Company, Inc. 1938. viii,
350 pp. \$3.50.

The authors of this book, feeling that most discussions of the advantages and disadvantages of chain stores had been partisan and unscientific, set out to make a "critical and comprehensive analysis" of the so-called chain store problem "in an unbiased and strictly impartial manner." Their task was not simple. The arguments to be evaluated were numerous, complex, and often highly colored. Satisfactory evidence was scarce.

The resulting book catalogs the advantages and disadvantages of chains, lists many of the arguments presented by proponents and opponents, and brings together many pertinent facts. That manifestly is a service to students of the subject. It is unfortunate, however, that the book was not edited more carefully. The style frequently is flowery; there is a tendency toward both redundancy and repetition; and there are minor mistakes. In many instances, greater restraint would have been desirable. Partly because

of this lack of restraint, some readers will infer that the authors were not strictly neutral but vacillated in their point of view, being first pro-chain and then anti-chain. The index is inadequate. Such words or phrases as the following are not to be found: supermarket, variety chain, limited price variety chain, Indiana, Supreme Court, Woolworth, Kresge, Newberry Grant, National Association of Food Chains, agriculture, farmers, and agricultural surpluses.

Again, one cannot accept unqualifiedly the authors' disagreement with the Bureau of the Census regarding the definition of a chain. Beckman and Nolen strongly favor treating any firm with two stores or more as a chain. This may be logical, but is somewhat unrealistic. Also, in citing the operating expense statistics published by the Bureau of the Census, or based on the Census data, the authors could have indicated specifically that the definitions adopted by the Census, although presumably necessary, resulted in final figures which understate the actual level of expenses in retail trade.

Beckman and Nolen conclude that the chains have made such important contributions to the efficiency of distribution and to the reduction of retail prices that to outlaw them is quite unthinkable. On the other hand, the authors say that the chains should not be allowed to develop free of all controls and discriminatory legislation. To quote from page 294, "there is, for example, the possession of monopolistic power in some cases and a definite trend toward monopoly in the chain system as a whole. Then there are the bad effects of absentee ownership and control, a tendency to lower wage standards and limiting the employment opportunities of white-collar workers, and a strong tendency to stifle individual economic opportunity. Above all, there are certain abuses of which chains have been found guilty, such as clubbing manufacturers into giving them unwarranted discounts and allowances of various kinds. Similarly, it is claimed that chains have been escaping their just share of certain taxes and community obligations "

Professors Beckman and Nolen believe, however, that, even where the chains are strongest, conditions do not call for governmental regulation of the type imposed upon the railroads and public utilities. They come out clearly in opposition to any attempt to offset or destroy the economic advantages, or to curtail the growth, of the chains. They suggest only that any abuses which have developed in the chain store system, and any "inequities" favorable to the chains, should be eliminated. The Robinson-Patman Act is endorsed as an effort to do away with the former, and scientifically devised taxes are suggested as a possible means of correcting the "inequities."

There can be little quarrel with these conclusions in principle. One may doubt, however, whether workmanlike research will disclose "inequities," as distinguished from economic advantages which should be preserved, sufficiently great to warrant substantial discriminatory taxation.

Approximately one-third of the book is devoted to reports, not previously published, upon a study of chain and independent stores in Florida which was conducted by Professor Beckman in 1935. One portion of this study had

to do with comparative prices of drugs, dry goods, and automobile accessories, as well as foods. Most such studies have been limited to foods. Another portion of the study was devoted to the measurement of "consumer buying-preferences," or patronage habits and motives, in foods, drugs, shoes, and women's apparel by income groups and, to some degree, by cities.

The entire Florida project was notable for the careful manner in which it was planned and carried out and for its wide coverage. It is well that a description of this piece of work and its findings finally is available in print. Many readers may refer to the present book more frequently for its report on this survey than for the broader discussion from which its title is derived.

Appendices provide convenient summaries of state laws imposing taxes on chain stores (as of July 1, 1937), of court decisions relative to such laws, and of city ordinances taxing chain stores. There are helpful chapters on chain store taxation and on other legislation affecting chains.

Although statistics are introduced from time to time, the use of these data gave rise to no complicated problems of method.

In all our thinking about the chain store's problem we should remember (a) that, to a large degree, this problem centers upon the food chains and (b) that the retailing of food is one of the more highly dynamic segments of our economy. During the last 25 years we have seen the old service wholesaler-service retailer system displaced extensively by the chain of small or neighborhood stores; we have seen the chain of this type transformed in important measure into the chain of combination stores with neighborhood stores as satellites; and now, at least in urban areas, we see the self-service supermarkets, with expense rates 20 per cent to 25 per cent smaller than those of the regular chains, cutting into the business so markedly that the chains themselves are beginning a second transformation by the opening of supermarkets.

The chain store problem became acute, and the states got around to strong anti-chain taxation, directed largely at the food chains, at about the time when economic evolution had decreed the reformation or decline of these chains. Presumably the supermarkets today constitute a much greater threat to the peace and prosperity of the food chains than any taxes now in effect or likely to be levied in the near future. The supermarkets, of course, are not adapted to the needs of extremely small communities and, even in the cities, they should not be expected to displace all the small neighborhood stores, independent or chain. Nevertheless, a realignment of interests is likely to take place. Chains which have no supermarkets shortly may find that their point of view closely resembles that of the smaller independents; and the two may combine to attack the supermarkets, whether independent or chain-owned. If punitive taxes are to be employed, a way may have to be found to vary these taxes on the basis of sales per unit rather than on the number of units; and attention may focus somewhat more on efforts to prevent price cutting than is the case today.

Considerations of this type received too little emphasis in the book under review. The discussion which it presents relates chiefly to a static condition;

and there is little indication in the book that this condition is about to change. Of course, this criticism is not so serious as some readers may infer, for many of the arguments advanced, both pro and con, with reference to chain stores as we have known them, will apply, perhaps with more force, in the discussions of the new problem on which the changes now under way will focus attention.

In addition, the chain store problem has been, and still is, of widespread interest and importance. Discussion of this problem has not been as calm and as factual as one might desire. This new book by Beckman and Nolen, despite its shortcomings, represents a worth-while addition to the literature of the subject.

CARL N. SCHMALZ

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Social Insurance Legislation and Statistics, A Study in the Labour Economics and Business Organization of Neo-Capitalism, by Benoy Kumar Sarkar. Calcutta: The Calcutta Publishers. Selling agents—U. Ray & Sons, 117-1, Bowbazar Street, Calcutta. 1936. xxi, 446 pp. Rs. 8/-.

This is at least as much a tract as a book on social insurance statistics and laws. It devotes, it is true, more than half its pages to these subjects, but this part of the book is quite clearly only documentation for the main argument. The argument is that the time has come for India, following the rest of the industrialized world, to adopt social insurance.

We are not unacquainted in this country, just emerging from the deliberative into the pioneer stages of social insurance, with books that succeed fairly well in being both scientific and partisan. But America has never produced so strange a combination of exhortation and figures, preaching, and facts. This for a variety of reasons. The world, says the author, has entered the second industrial revolution: its leading characteristics are "technocracy" (the European "rationalization"), "trustification," and rapidly expanding state control of business. A collateral characteristic, and one that Sarkar sees related very intimately to these others, is the world-wide spread of social insurance. The neo-capitalist, the capitalist of the twentieth century, has been "to a certain extent perhaps chastened by the impact of the working classes and the community in general" (p. 77). Social insurance is one of the results. But India is barely on the threshold of her *first* industrial revolution. The employing class is still very much in the saddle, the state stands still on the sidelines; most important, neither labor nor community is socially minded. Organized labor is still the exception, and the few unions are not strong. The community tends to think in terms of the putative glories of a Golden Age of the long past, in the forms of a caste system that has shaped India's life and thought since the dawn of man.

The author, that is, has set himself an impossible task: to shake his countrymen out of their ancient lethargy, force them to skip at least a century in industrial history and no one knows how many centuries of social

and political history, jump straight into social insurance, essentially a twentieth-century "improvement." "Social assurance is not yet a question of practical politics;" in the meantime he is appealing to the two groups he is convinced hold the key to India's future: the workers and the clerks. It is significant of India and of the nature of the author's task that he feels he needs to devote one chapter to "The Dignity of the Clerical Service," one to "The Nation-Building Functions of Clerks." The long and often dull pages of statistics in the middle of the book are for "students of statistics, economic history and political developments." The tocsin, delivered at the beginning and end of the book, without statistics, is for the underprivileged. The pitch of the latter may be judged by the author's statement that there is in India an "unreasonable gospel of hatred" against clerical service, that even "gazetted officers in government service have learnt to consider themselves as almost worthless human beings" (p. 94).

One other fact makes the nonstatistical sections of the book less than completely logical and orderly to the Occidental mind. It is the apparent necessity of making both a general economic and a specific case for social insurance. Marshall and John Stuart Mill, not to mention Pareto and Sorokin, are adduced to prove that social insurance costs can be paid and that social insurance benefits are an addition to and not a substitute for wages. On this point Sarkar is himself not very clear. He seems to accept the iron law of wages on page 427; on pages vii, 408, and 412 he concludes that the needs of the worker "can therefore be satisfied to a certain extent and within certain limits by the provision of wages at rates which are beyond those dictated by free competition and the iron law" (p. 428).

It is not surprising, therefore, to find that Sarkar has no detailed Indian social insurance program. Though he chides Indian workers with fanning the air with programs so broad they never get down to details like wages and specific social insurance plans, he really gets not much closer. He urges the middle class to hasten the industrialization of India because labor upheaval will help them (it seems the other way about to the American and European); he opposes state contributions to social insurance because they are a dole to the capitalist; his most specific recommendation is that the clerks ally themselves with the manual workers. He strongly suggests that labor unions are essential for social insurance administration, although neither British (except for health insurance and then to a minor degree) nor American experience indicates that this is so. I think he quite misunderstands the experience of the entire world when he says that "the business aspect (of social insurance) has too long escaped the attention of the insurance companies" (p. 407). Social insurance is not private insurance, and mischief generally follows when they are confused.

The statistical and legal materials are mainly to provide social insurance and related comparisons for the leading industrial countries, particularly Germany the pioneer and Great Britain the homeland. The sources are generally secondary, too often out-of-date. When available, Indian materials are given. The feel of this part of the book is conveyed in the author's

reference to his comparative statistics on public finance. "We are neither interested in the discrepancies of estimate for the present nor in the scientific comparison between country and country."

C. A. KULP

University of Pennsylvania

Profit Sharing for Wage Earners, by C. Canby Balderston. New York: Industrial Relations Counselors, Inc. 1937. viii, 157 pp. \$2 00.

In the never-ending search for an easy formula for harmonious relations in industry, the device of profit sharing has been rediscovered and hailed anew at almost every upturn of business for the better part of a century. During the 1920's however, much of the enthusiasm for profit sharing was diverted to employee stock ownership. Following sad experiences with this twentieth century substitute, interest in the older form of making "enterprisers" out of wage earners revived in 1936 and early 1937. Despite the succeeding reversal in business, the recent Congress became sufficiently impressed by the promises of industrial peace and prosperity advanced by the advocates of profit sharing to appropriate \$30,000 to study it further.

With Professor Balderston's excellent monograph at hand, Congress might well have saved the country the cost of another survey. In 68 pages of text and a 76-page appendix, Professor Balderston concisely summarizes the history of profit sharing, its objectives, the factors affecting success or failure in its use, the structure of plans, and experience under them. In a final chapter he outlines the conditions under which a profit-sharing plan might be justifiable. The appendix includes verbatim statements of three active plans of a type which the author approves as well as tabular summaries of a large number of other American and British plans. Many carefully prepared tables and charts supplement the text.

Although the author concludes "that profit sharing has real merit," he states that extreme care must be exercised to determine the suitability of the particular situation and the soundness of the plan in relation to it. Standing alone, he holds, profit sharing is a weak device. It should be the culmination of a well-rounded personnel policy under which properly financed plans protect employees in times when earnings decline or disappear. The author recommends that any share in extra profits be deposited in a fund to strengthen or liberalize such protective programs rather than disbursed as cash bonuses. With ample provision against the hazards of old age, unemployment and sickness, he believes, profit sharing should be used to subsidize employee savings.

The author would probably agree that scarcely a dozen companies in the country are justified in inaugurating a profit-sharing plan in the face of these requirements. Rather than an easy formula, profit sharing becomes under this prescription the cornice of an elaborate and costly structure of protective programs. Even then there seem to be grave doubts as to its advantage compared to a farsighted policy of payroll reserves and employment stabili-

zation. Professor Balderston indicates the failure of profit sharing as an incentive, its tendency to accentuate fluctuations in earnings, and the objections raised against it by organized labor. With a high mortality rate in the past and a necessity of sustained nursing in the future, it appears that profit sharing is too delicate a brain child to resist the rigors of industrial relations today.

Underlying the practical difficulties of profit sharing is the fundamental confusion of concepts inherent in the device. The capitalistic system is based on the principle that profit is the noncontractual reward of successful enterprise, whereas wages are the compensation of workers who give up the chance of uncertain gains in exchange for a more stable income. As an economic system, capitalism is accepted in a democratic society so long as it serves to protect and enhance the livelihood of the great mass of citizens. Rather than a greater sharing of risk, our people seem to be seeking a greater measure of security. Although incentive remains an essential prerequisite to continued progress, as well as to security itself, our industrialists will need to find more constructive means of stimulating incentive than adding to the uncertainty of wage-earner incomes. Professor Balderston's monograph, although perhaps a little too considerate, serves clearly and effectively as a warning to thoughtful industrial executives.

J. DOUGLAS BROWN

Princeton University

British Methods of Industrial Peace, A Study of Democracy in Relation to Labor Disputes, by Ducksoo Chang. New York: Columbia University Press. Studies in History, Economics and Public Law, Number 425, Edited by the Faculty of Political Science of Columbia University. 1936. 332 pp. \$4.25.

Out of this excellent, first-hand study of labor relations and government attitudes toward collective bargaining in Great Britain during the past century or so come a number of conclusions which are of prime significance to all Americans who are looking for a road to industrial peace in the United States. On the basis of his survey of prewar, war, and postwar experience in England as a whole and in five important industries (coal mining, railways, iron and steel, engineering and shipbuilding, and cotton textiles), the author finds (1) that labor peace based on industrial democracy—i.e., on good-faith recognition of unions by employers—is the only enduring peace in a free country dedicated to political democracy; (2) that most labor issues can be settled voluntarily, without government intervention, through collective bargaining, based on the will-to-agree, between strongly organized unions and employers; (3) that, nevertheless, when the collective bargaining process breaks down (as it occasionally does over major issues), government should be ready, with agencies for mediation and voluntary arbitration, to step in and help the disputants find a common, face-saving basis for settlement; (4) that compulsory settlement of labor disputes by government agencies is not

desirable in a democracy; and (5) that under "voluntary" government intervention there will be, rather than the application of rigid rules or principles of settlement, the making of decisions based on expediency and on the relative economic strengths of the disputants.

CARROLL R. DOUGHERTY

University of Pittsburgh

Newspapers and the News, An Objective Measurement of Ethical and Unethical Behavior by Representative Newspapers, by Susan M. Kingsbury, Hornell Hart, and Associates. New York: G. P. Putnam's Sons. Bryn Mawr College, Series in Social Economy Number One. 1937. xi, 238 pp. \$2.50.

The authors of this study originally undertook to make "a comprehensive and scientific investigation" into the ethical standards which govern the handling of news and advertising by American newspapers. In practice, the scope of the survey was considerably narrowed. It still represents a highly ambitious attempt, however, in that it endeavors to evaluate the ethical standards of some 44 "representative" newspapers by the use of quantitative measures.

The evaluation of individual newspapers unfortunately has little current value, since it is based chiefly upon an analysis of front pages published during July, 1929. In the intervening years, some of these newspapers have gone out of existence and others have changed ownership. All of them have been subjected to the severe strains of a prolonged depression. One can only conjecture whether these circumstances have made any substantial changes in the ethical standards of the papers concerned.

For the readers of today's newspapers, interest in the study must, therefore, center upon the methodology used. This consists primarily of working out a series of ingenious indexes of ethical and unethical behavior which carry such names as the spectrum of news interests, the index of newspaper bias, and the index of pernicious medical advertising. The basic measure is usually the space given, especially in headlines, to various types of news or advertising, opposing sides in a controversy, undesirable advertising, and the like. No attempt is made to set up an ideal or absolute standard. The authors content themselves with working out "representative" figures for actual newspaper practice and grading individual newspapers according to the extent to which they fall above or below the "representative" level. It is evidently the hope of the authors that their indexes can be computed periodically and that the managements of individual newspapers can be induced to improve their practices in areas where they are graded relatively low.

The present reviewer cannot accept wholeheartedly the faith of the authors that their work is completely "objective" and "scientific." For example, throughout the study, both in mapping out procedures and in applying them, it has been necessary repeatedly for the staff to make conscious or unconscious judgments of qualitative values. It is quite doubtful whether another staff, given the same materials and a description of the procedures,

would come out with identical results. Again, the analysis of readers' interests is quite arbitrary and incomplete, and the authors give no convincing arguments to support their belief that an appeal to some kinds of interest is "ethical" and an appeal to other kinds of interest is "unethical." Yet again, the space given to different kinds of news is not always a good indicator of newspaper policy. An important news "story," such as a national election, the flight of Lindbergh to Paris, the kidnapping of the Lindbergh baby, the abdication of Edward VIII, the destruction of Shanghai by Japan, and the annexation of Austria by Germany, will capture the front page of practically all newspapers. The important test here is not so much the space allotted as the point of view of the reporters, in newspaper parlance "the angle which is played up." Similarly, the unequal allotment of space to opposing sides in a controversy may result not from bias so much as from the fact that one side makes an effective presentation of its case whereas the other side is dull and ineffective, or that one side is represented by conspicuous and colorful spokesmen as against obscure, colorless opponents, or that one side presents its case on a day when news is scarce whereas the other picks a day when competition for the front page is severe.

Despite the shortcomings indicated by these examples, the study is an interesting attempt to deal by the use of quantitative measures with a difficult and important subject. As such it deserves sympathetic attention from everyone concerned with the problems of newspaper ethics.

The foregoing comments apply to the first two-thirds of the study. The last third lists and describes previous "objective" studies of newspapers and presents an admirable bibliography. Although it will be of less general interest, this section will be indispensable to future students in the field.

REAVIS COX

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Land Utilization in China, A Study of 16,786 Farms in 168 Localities, and 38,256 Farm Families in 22 Provinces in China, 1929-1933, by John Lossing Buck. A Report in the International Research Series of the Institute of Pacific Relations. Published by the University of Nanking. Chicago: University of Chicago Press. 1938. Vol. 1, *Text*, xxxii, 494 pp. \$5.00. Vol. II, *Atlas*, xii, 146 pp. \$5.00. Vol. III, *Statistics*, xv, 473 pp. \$10.00. The Set \$15.00.

The appearance of Dr. John Lossing Buck's *Land Utilization in China* is a major event in our understanding of Chinese life. Whereas almost all previous studies of the rural scene have necessarily been based on unsupported generalizations, we now have a wealth of first-hand statistical data carefully collected, painstakingly analyzed, and attractively presented.

These three volumes are the result of a decade of field study throughout China south of the Great Wall. The work has been carried on in the College of Agriculture and Forestry at the University of Nanking, aided by liberal grants from the Institute of Pacific Relations and various official Chinese

organizations. Scores of Chinese and foreign scholars have been associated with the project.

Land utilization is interpreted broadly. The statistical study includes all aspects of agricultural economics as well as population and nutrition problems. Excellent descriptions in Volume One also deal with the geographic problems of topography, soil, climate, and land resources. Unfortunately there are few data from Manchuria, owing to the hostilities of recent years. The appearance of the study at this time is particularly fortunate, since it may be many years before a similar survey will be possible. The implications as to China's welfare and economic possibilities are fundamental.

Dr. Buck's study is based upon field work in 168 representative localities in 22 of the 28 provinces. Each of the 13 regional investigators was a graduate of the College, and local investigators were carefully trained. Detailed schedules were filled out for one hundred farms in each area. On the basis of the data collected the country was divided into eight agricultural regions. The north is characteristically wheat land, and the south is rice land.

Agriculture in China is less efficient than sometimes thought. Large amounts of labor are applied to the fields, but the yields are not commensurate. Rice harvests per acre are higher than in Japan but less than in the United States. Wheat yields are about the same in China and the United States, but, in general, crop yields are less than elsewhere. The production per man-equivalent (one adult farmer working a full year) is 14,000 kilograms in China compared with 20,000 kilograms in this country. Whereas it requires 26 man-equivalent days to raise an acre of wheat in China, 1.2 days suffice in the United States. Taxation averages four times as much per acre as in the United States.

Detailed population analysis shows an average rural density of 1,500 per square mile of land under cultivation. The birth rate appears to be at least 38 per 1,000, with a death rate of 27. The density and rapid increase of population is one of China's major problems. There is no additional arable land, emigration is impossible, and industrialization is uncertain.

Detailed statistics support all statements. Field work involved filling out elaborate farm and personal questionnaires, and these have been tabulated in a variety of ways. The specialist will find a large amount of detail concerning all aspects of rural life. As examples, five tables at random cover the number and area of graves in farms; the percentage of farmers who are owners, part owners, and tenants; the chemical composition, calorific value, and vitamin value of foods consumed; the number and kind of livestock per farms; and the number of rooms, doors, and windows per capita.

Volume One presents a broad picture of the land and its problems, with chapters on agriculture and its regionalization, topography, climate, soils, crops, livestock, the farm business, marketing and prices, population, and standards of living. Volume Two is the Atlas, with 170 maps which present the statistical material tabulated in Volume Three. Over 300 tables provide a wealth of specialized data for further analysis.

Land Utilization in China is a work of fundamental importance, both as

an interpretation of China and as an example of procedure in agricultural economics. Until adequate census data are someday available, this collection of sample studies will be the standard source of statistical information on China. Dr. Buck and his colleagues have accomplished an exceedingly difficult task with unusual success.

GEORGE B. CRESSEY

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Part-Time Farming in the United States, Prepared under the supervision of Z. R. Pettet, Chief Statistician for Agriculture. Washington, D. C.: Bureau of the Census, United States Department of Commerce, U. S. Census of Agriculture: 1935. 1937. 205 pp. 50 cents.

In this publication the Census Bureau presents data collected in the Census of 1930 and of 1935 relating to part-time farming in the United States. Much of the data included are new and are in addition to the data presented relating to part time farming in the regular volumes of the 1930 and the 1935 Census reports. The Bureau states that one of the primary purposes underlying the study was to delimit the areas where part-time farming occurs.

New data presented include the number of days worked for pay or income not connected with the operator's farm in 1929 and a further breakdown of the number of days worked off the farm in 1934. Part-time farmers for 1934 are classified by color and by tenure status. Tables 7, 8, and 9 present data from the 1930 Census relating to the nature of the off-farm work. It is interesting to note that, for the United States as a whole, the rural farm male population having nonagricultural pursuits represented only 3.5 per cent of all males having nonagricultural pursuits. For forestry and fishing it was 16.9 per cent, for mining 7.2 per cent, and for automobile factories and metal industries 2 per cent. One-half the volume is devoted to an analysis of the organization of the so-called part-time farms as contrasted with all farms as a group in 13 widely scattered counties and in the Columbus, Ohio, metropolitan area. It is stated that the Columbus area was selected to study the organization of part-time and non-part-time farmers in a thickly populated locality and the organization of the same type of farms in a locality less thickly populated when the two areas offered the same general opportunities to farm operators for outside work.

The volume makes available much new data relating to the nature of part-time farming in the United States. One must keep in mind, however, the Census definition of a farm which for 1929 and 1934 did not include tracts of land of less than three acres unless its agricultural products for the year were valued at \$250 or more; furthermore, that to have been classed as a part-time farm the operator must have worked off the farm for pay. Some other member of the family working off the farm for pay would not make the farm part-time. It is the opinion of the reviewer that too much reliance should not be placed upon a comparison of the 1929 and 1934 data,

owing to the probable inadequate reporting of small farms by the Census of 1930.

It is to be hoped that the Bureau of the Census may find it possible to make a somewhat similar study of the characteristics and occupations of non-farm rural residents.

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- AFTALION, ALBERT. L'Or et la Monnaie, leur Valeur. Les Mouvements de l'or. Paris. F. Loviton et C^{ie}. 1938. 124 pp. 25 francs.
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- AMOS, J. ELLWOOD. The Economics of Corporate Saving. Urbana, Illinois: University of Illinois Press. 1937. 136 pp \$1.50.
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* Beginning with this issue, the Journal will carry a list of publications received. Items that are not of interest to statisticians will be omitted from the list. The contents of periodical publications will not be listed but the attention of the reader is directed to the lists of articles in current publications which are to be found in the *Revue de l'Institut International de Statistique*, *Journal of the Royal Statistical Society*, *American Economic Review*, *Population Index*, *Transactions of the Actuarial Society of America*, *The Record of the American Institute of Actuaries* and *Sankhyā*, *The Indian Journal of Statistics*.—Editor.

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THE MISUSE OF STATISTICS

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The safety of science depends on the existence of men who care more for the justice of their methods than for the value of any results obtained by using them.¹

While we have come a long way in the past twenty years in the collection and availability of statistical data and in the minute refinement of statistical methodology, we have been noticeably backward in detecting and publicizing statistical misuses. Though instances of such misuse occur more frequently today, doubtless because of the far greater employment of statistical data in contemporary debate and discussion and due to the fortunately growing tendency of basing economic speculation on a statistical and factual foundation, nevertheless a survey of the literature of the past reveals its quota of cases. The Classical economists made little use of statistics. Adam Smith spoke disparagingly of what he termed "Political Arithmetic,"² declaring bluntly "I have no great faith in political arithmetic . . ." ³ Dugald Stewart, with equal skepticism declared,

. . . instead of appealing to political arithmetic as a check on the conclusions of political economy, it would often be more reasonable to have recourse to political economy as a check on the extravagancies of political arithmetic ⁴

This mistrust may be attributed to two circumstances; the statistical data available at the time were fragmentary and unreliable. Smith himself takes note of an instance of poor coverage and inadequacy in the statement:

A great part of the extraordinary work, besides, which is probably done in cheap years, never enters the public registers of manufactures. The men servants who leave their masters become independent laborers. The women return to their parents, and commonly spin in order to make cloaths for themselves and their families. Even the independent workmen do not

¹ Cohen, Morris R., on "Scientific Method," in *The Encyclopedia of the Social Sciences*

² "By Political Arithmetick, we mean the Art of Reasoning, by Figures, upon Things relating to Government." Sir Charles Davenant's definition in *Discourses on the Public Revenues, and on the Trade of England* (London, 1698), Part I, p. 2, see also Stephen Bauer's "History of Political Arithmetic," in *Palgrave's Dictionary of Political Economy*

³ Smith, Adam, *Wealth of Nations*, Book IV, Chapter V, Cannan-Modern Library Edition, p. 501.

⁴ Stewart, Dugald, "Elements of the Philosophy of the Human Mind," Part II, Chapter IV, Section 5, in *Collected Works* III, pp. 331-2

always work for public sale, but are employed by some of their neighbors in manufactures for family use. The produce of their labor, therefore, frequently makes no figure in those public registers of which the records are sometimes published with so much parade, and from which our merchants and manufacturers would often vainly pretend to announce the prosperity or declension of the greatest empires.⁵

Secondly, this inadequacy of data gave rise to a number of celebrated controversies, in which the leading participants came to diametrically opposite conclusions, thereby discrediting their procedure and bringing their methodology into disrepute. A famous pamphleteer, Richard Price, attempted to show that the population of England had declined by slightly less than 30 per cent in the century after the Revolution of 1688. He compared estimates based on the hearth-money tax collected at the beginning of the period with estimates based on the inhabited house receipts at the end of the period. The data were not comparable and hence his surprising result. Someone else, using parish registers, concluded on the other hand that there had been a steady increase in the population over the period.

Ricardo's controversy with Bosanquet served to strengthen the faith in theory and weaken the case for statistics. Bosanquet had attacked the conclusions of the Bullion Committee upon which Ricardo had served. Though admitting the theoretical logic of the Committee's contentions, Bosanquet advanced statistical tables on foreign exchange between Hamburg, Paris, and London to disprove them. Ricardo, with his complete knowledge of exchange rates derived from a lifetime of business experience, was able to demonstrate numerous sources of error which rendered the tables invalid and with some feeling declared:

... For any man to compare the account of the Hamburg exchange, and of the Parisian and not to see that the accounts were incorrect, that the facts could not be as so stated, is very much like a man who is all for the facts and nothing for theory. Such men can hardly ever sift their facts. They are credulous, and necessarily so, because they have no standard of reference. These two sets of supposed facts, those in the Hamburg exchange on the one hand, and those in the Parisian on the other, are absolutely inconsistent and disprove one another. That facts such as these should be brought forward to invalidate a theory, the reasonableness of which is allowed, is a melancholy proof of the power of prejudice over very enlightened minds.⁶

Instances might be multiplied.⁷ The principles to be drawn therefrom would not be changed. Theorists long harboured a justifiable mistrust of statistics, because of the early inadequacy of available data, because

⁵ Smith, *op. cit.* p. 85.

⁶ Ricardo, David, "Reply to Mr. Bosanquet's Practical Observations on the Report of the Bullion Committee," in *Economic Essays of David Ricardo*, edited by E. C. K. Gonner (London, 1923) p. 82.

⁷ See Knies, Karl, *Die Statistik als selbständige Wissenschaft* (Kassel, 1850). An account of Bodin's controversy with his contemporary Malestroit over the trend of prices may be found in *Les Six Livres de la République* (Paris, 1576) Book 6.

of a permanent inability to prove or disprove certain types of theory (a theory of value, for example) by resort to statistics,⁸ and later because of the apparent success of maintaining both sides of a controversy by the introduction of different collections of statistical data. It is precisely this last factor which has been so greatly responsible for the popularization of statistical technique in this country during the past quarter century. Well might General Francis A. Walker declare, "The American people are intensely and passionately devoted to statistics" and Professor North add some years later "Popular interest has grown since."⁹

It has become an accepted American pastime in politico-economic controversies to attempt to "prove" and "disprove" by means of statistical data. As a consequence an alarming number of instances of the misuse, misinterpretation, and perversion of statistics by partisans is apparent to one whose eye is focused for such observation. Errors frequently escape us because we do not look for them. If we really search for them we should find that they are much more numerous than we suspect. A pro-New Deal evening newspaper carried the following column headline and lead on its financial page:

ELECTRIC OUTPUT IN SEASONAL RISE

Electric power production for the week ended May 28 rose substantially above the total of the previous week . . . ¹⁰

The next morning an anti-New Deal paper carried the following dispatch:

POWER OUTPUT OFF 10.6 % FROM 1937 FIGURES

The production of electricity in the United States in the week ended May 28 was 1,973,000,000 kilowatt hours, a drop of 10.6 per cent from the 1937 week according to the Edison Electric Institute.¹¹

The probability is that this apparent contradiction involving misuse escaped general detection. While to the trained statistician the fallacy involved is obvious, how puzzled and confused must have been the average layman who had the misfortune to stumble across both dispatches. Had he read only the *Post* item how misled he would have been.

The author has over the past few years been investigating instances of the misuse of statistics. Much has been done. A great deal more, along lines to be indicated, remains to be accomplished. The mass of

⁸ See "Quantitative Analysis in Economic Theory" by W. C. Mitchell, Presidential Address before the American Economic Association, *American Economic Review*, March, 1925.

⁹ North, S. N. D., "Seventy-Five Years of Progress in Statistics," in the *History of Statistics*, edited by John Koren (New York, 1918).

¹⁰ *New York Post*, June 2, 1938.

¹¹ *New York Herald Tribune*, June 3, 1938.

cases which has been collected appears on the one hand to call for classification; on the other to defy it. A preliminary attempt reveals that errors are to be found in every phase of statistical method and every field of statistical data. A classification along functional lines of methodology would treat of errors involved in index number construction, use of averages, correlation, etc. A topical classification on the basis of fields of data would consider errors in wealth and income statistics, price statistics, foreign trade statistics, etc.

Obviously the two types of classification would overlap. Within one topical group such as labor statistics there are to be found errors of various functional types. The topical type classification, when fully developed, will be of most use to workers specializing in a particular field. The functional type classification will interest statisticians concerned with methodology. In the discussion which follows, in which cases will be cited to illustrate the various types of error, it is to be noted that we are concerned with, as the title of this article clearly states, the misuse of statistics; with attempts to select and arrange data in such a way that desired, and therefore unjustifiable conclusions may be drawn, and with instances where incorrect inferences are drawn from valid data. The trained statistician absorbed in the improvement of technical procedure grows careless in interpretation, or, more usually, leaves the presentation and popularization of his data to statistical amateurs on whom the word "caution" exerts no restraining influence.

The results of statistical investigations are usually stated in numerical form and are therefore, in the public mind, assigned a degree of definiteness usually associated with mathematical technique. The careful investigator, however, is constantly aware of the fact that the preciseness of his numerical result varies directly with the degree of care used in selecting, from the larger universe, the sample upon which his study is based. The numerical conclusions derived from a study of the sample are held to be characteristic and representative of the universe. A very common error in statistical investigation is the selection of a sample which is not an accurate cross-section of the larger universe but merely a particular, unique segment. Conclusions drawn from the biased sample will not, of course, accurately reflect the larger universe. The misuse occurs when such conclusions are held to be representative of the universe by those who either deliberately or unconsciously overlook the sampling bias.

The nature of erroneous sampling and the damage wrought by conclusions drawn from it was most vividly and dramatically impressed

upon the public mind in the *Literary Digest* poll fiasco at the time of the 1936 Presidential election. Over ten million ballots were mailed out by the *Digest* and it was expected that the very large size of the sample would overcome the lack of scientific selection. Unfortunately for the *Digest*, however, the mailing list was drawn from telephone books and lists of automobile owners. A definite bias in favor of high income, anti-New Deal opinion was introduced and reflected in the poll's conclusion that Governor Landon would win. The American Institute of Public Opinion sent out 275,000 ballots. The magazine, *Fortune*, interviewed 3,000 persons. The small size of both samples was more than compensated for by the very careful selection and inclusion of all economic groups in the population. The much greater accuracy of the Institute and *Fortune* polls demonstrated that where great care is taken in the selection of a representative sample, size becomes less important.

A check of samples by census tracts in a study of the size of families in a certain area revealed that the samples had indicated larger households than were actually true of the district. The difference was not due to faulty selection so far as nativity, race stock, and economic status were concerned. It was then discovered that the enumerators failed to revisit all families not at home when they called. Obviously the larger the family the greater the likelihood of someone being home when the enumerator called. Childless, married women were more likely to have been at work or engaged in social routine away from home.¹²

The pitfalls of sampling are presumably eliminated by a census which covers the entire population. Often, however, even in the case of a census complete accuracy is more imagined than real. In China, one census, taken for poll-tax and military purposes, returned a population of 28,000,000. A few years later when the same statistics were gathered over the same territory, this time for famine relief, the population increased to 105,000,000. Women, between the ages of 18 and 25, are notoriously more numerous in the census than in real life. Negroes in the South live to amazing old ages in statistical investigations. With poor birth records and the widely prevalent tendency for old people to overstate their ages, how much reliance can be placed on records indicating great life span for members of a race whose death rate is very high?

Where the census is taken periodically and the spirit of scientific

¹² Kiser, Clyde V, "Pitfalls in Sampling for Population Study," in this JOURNAL, Vol. XXIX, p. 251.

progress prevails, it is natural that methods of enumeration and coverage should be improved. This improvement, which has taken place in the United States,¹³ leads to erroneous conclusions in the interpretation of census data. Some years ago a feverish apprehension over the fear of Negro domination of the country seized many people and a good part of the press. On the face of the census returns Negroes had increased much more rapidly than whites between 1870 and 1880. Reputable statisticians hastened to point out that the census of 1870 had been particularly deficient in the enumeration of Negroes in the South and that the census of 1880 had been conducted on a much more efficient and scientific basis, but it was difficult to stem the tide of propaganda.¹⁴ Erroneous comparisons of this type, due here to improving coverage, may likewise arise because of changing classification or definition.

Difficulty may be evaded in comparisons, Professor Bowley warns,

... so long as precisely the same definition and the same classification are preserved. It is usually indifferent on which side of a line relatively small marginal quantities are placed; the rate of change is hardly effected. More important is the consideration that while very varying estimates may be made by different investigators for one date the change shown over a period is definite if the method and classifications are the same throughout.¹⁵

There was an 8 per cent increase in the death rate from syphilis in New York State in 1937 as compared with 1936. Does this necessarily mean that there was an increase in syphilis or in mortality due to syphilis? In view of the widespread campaign during 1937 to publicize the nature and causes of syphilis and popularize remedial treatment, one doubts that the disease is increasing. Rather the apparent increase in mortality due to syphilis may be attributed to the fact that doctors are no longer reluctant to ascribe death to syphilis on the death certificate. Formerly physicians were hesitant about stigmatizing the deceased and rather than attribute death to syphilis would give "heart disease" as the cause.

Articles contrasting full employment in Germany with mass unemployment here are completely misleading. It is impossible to compare the unemployment figures because the definition of an unemployed person in Germany differs widely from any definition used in this country. In Germany young people in the Labour Force are counted as employed. The Director of the Institut für Konjunkturforschung, Dr. Wagemann visited this country last year and was

¹³ See Holt, W. Stull, *The Bureau of the Census—Its History, Activities and Organization* (The Brookings Institution, Washington, 1929); also Reed, V D, "Comparability versus Change," in this JOURNAL, December 1937

¹⁴ Gannett, Henry, "Statistical Blunders," in *Forum*, 1901

¹⁵ Bowley, A. L., *Wages and Income in the United Kingdom Since 1880* (Cambridge, 1937), p. viii.

amazed to learn that our CCC boys and those engaged in public works construction are counted as unemployed.¹⁶ All persons employed by the government in any capacity in Germany are counted as employed.

Prior to our entry into the World War, the *Navy Year-Book*, in keeping with the desires of the advocates of preparedness, juggled figures: counted obsolete or obsolescent vessels in listing the navies of Germany and other countries but omitted them in our case; counted certain German and other battleships, building or provided for, but omitted similar ones for the United States and thus made our Navy appear inferior.¹⁷

An excellent example of how one may supply data to support either side of a controversy by varying classification is found in the perennial dispute over the status of the middle class. One may prove, as one wishes, that the middle class is increasing or decreasing. It is largely a matter of classification, of defining what groups are to be included within that nebulous classification "middle class" and what groups are to be excluded.¹⁸

The study of marriage statistics in Japan presents difficulties because of changing classifications. Ryoichi Ishii in his very cautious and careful study¹⁹ indicates that in Japan there are a considerable number of couples who are informally married. Regular religious or social ceremonies are performed but the unions are informal because they are not registered, which is a necessary requirement for the legal validity of a marriage in Japan. Many marriages because of certain legal complications are not registered. After the first census of 1920, however, the official attitude was relaxed and census authorities reported not only legal but also informal marriages. It is impossible, therefore, with any degree of statistical accuracy, to compare marriages in Japan in say 1890-1900 with marriages from 1920-1930.

Figures on the distribution of races in different countries and continents are in a chaotic, non-comparable, state and very misleading.²⁰ American agricultural statistics are inaccurate and misleading because of the Census Bureau's inconsistent definition of a farm, Professor Brandt claims.²¹ It is improper to compare farm and non-farm incomes,

¹⁶ Dr. Wagemann is the author of a volume entitled *Narrenspiegel der Statistik* which deals with the pitfalls of statistical investigation. [See p. 755 Ed.]

¹⁷ See Arnett, Alex M., *Claude Kitchen and the Wilson War Policies* (Boston, 1937), p. 61.

¹⁸ See Appendix A of *Insurgent America* by Alfred Bingham; also Corey, L., *The Decline of American Capitalism*, and Hansen, A. H., "Industrial Classes in the United States in 1920," in this JOURNAL, Vol. 17, p. 417 and Vol. 18, p. 503.

¹⁹ Ishii, Ryoichi, *Population Pressure and Economic Life in Japan* (London, 1937), pp. 92-3.

²⁰ See Kuosynski, Robert, *Population Movements* (Oxford, 1936), pp. 81-6.

²¹ See Brandt, K., "Fallacious Census Terminology and Its Consequences in Agriculture," in *Social Research*, February, 1938; also Black, J. D. and Allen, R. H., "The Counting of Farms in the United States," in this JOURNAL, September, 1937.

as is so often done, Professor Morgan feels, because the statistics on farm income are consistent underestimates.²²

John A. Hobson holds that the parade of working class savings periodically presented in the British press only conceals a growing maladjustment by its failure to produce for comparison the rates of saving among the non-working class and by attributing to the former all Post Office savings which he demonstrates are largely deposited by non-workers.²³

A bewildering and contradictory barrage of unemployment estimates has been loosed on the American public in recent years. Thus for the month of November 1935 the following estimates of the number of unemployed were made:

The National Industrial Conference Board	9,177,000
Government Committee on Economic Security (September 1935)	10,915,000
The American Federation of Labor	11,672,187
National Research League.	14,175,000
Labor Research Association	17,029,000

Six months later the United States Chamber of Commerce estimated the number of unemployed at 4,000,000 and the *New York Sun* announced that on the basis of a survey of 30,000,000 workers unemployment amounted to between, 3,000,000 and 3,500,000. The Labor Research Association insisted that all estimates lower than its own were erroneous. The Chamber of Commerce held that all estimates higher than its figures were inaccurate.²⁴ William Green attacked the *Sun's* estimate and the *Sun* in equally uncomplimentary fashion analyzed the Federation's figures.²⁵ Statisticians were amused, the public bewildered. The obvious cause of the difficulty was a matter of classification and definition. The Labor Research Association's estimate included unemployment among farm labor. Other estimates did not consider farm labor.²⁶ Allowances for persons leaving school, seeking work but never having had a position before, varied. The higher estimates of unemployed included a one million correction of the United States Census of April, 1930. Despite the mass of reputable statistical opinion in favor of this correction, those responsible for the lower estimates made no such allowance. Unemployment among professionals was not considered in the lower estimates. The subject need not be

²² Morgan, O. S., "Farmers Aren't So Poor," in *Independent Journal of Columbia University*, March 18, 1938.

²³ Hobson, J. A., *Confessions of an Economic Heretic* (London, 1938), pp. 183-4.

²⁴ Report of the Special Committee on Employment headed by John W. O'Leary presented to the Chamber, November 20, 1936, p. 3.

²⁵ For the exchange of letters see *The New York Sun*, June 5, 1936.

²⁶ "Methods of Estimating Unemployment," Report of the Labor Research Association, June 1936

pursued further.²⁷ Varying coverage, differences of classification and unlike definitions render data non-comparable, confusing, and where comparison is insisted upon, misleading.²⁸

Errors of comparison may arise because of the neglect of population change, changing price levels and other miscellaneous factors. Shortly after the World War there was an outcry against the high rate of taxation. Figures on tax collections were cited to show that taxes in 1920 represented a 320 per cent increase over those of 1913. As Shultz indicates, no account was taken of the sharp rise in prices over the period 1913-20. If we deflate the tax figures by eliminating the element of inflated prices and consider the tax burden, as it logically should be considered, in terms of purchasing power taken away from the taxpayer, we find that the tremendous tax collections of 1920 represented an increase, not of 320 per cent, but of 90 per cent over those of 1913. If the increase in population be taken into account as well, it would be found that per capita taxes rose less rapidly than collections stated either in actual or in "constant purchasing power" dollars.²⁹ The comparison of the relative tax burdens of countries or cities is frequently misleading in that no account is taken of the facilities and services furnished for the taxes paid. The citizen of the low tax community may be forced to forego such services and facilities or else purchase them privately at a greater price than if they had been placed on a communal basis and paid for by taxes.

In the spring of this year, when sentiment in the business community was low, the *New York Post* in an editorial designed to promote optimism cited statistics on retail sales to prove that conditions were really better than people imagined. Figures showed retail sales in April of 1938 to be higher than sales in April, 1937. The editorial neglected to mention, however, that the Easter holiday in 1937 fell at the end of March and that Easter shopping was therefore concentrated in the middle two weeks of March, whereas in 1938 Easter occurred in the

²⁷ Close attention has been given in recent years to unemployment figures, see Hogg, M. H., "Sources of Incomparability and Error in Employment and Unemployment Surveys, in this JOURNAL, September, 1930; Nathan, R. R., "Estimates of Unemployment in the United States, 1929-35," in the *International Labour Review*, January, 1936, Humphrey, D. D., "Some Adjustments in Census Data on Unemployment," in this JOURNAL, December, 1937; Kreps, T. J., "Estimates of Unemployment During the Last Four Years," in this JOURNAL, March, 1934 Supplement, also "An Attempt to Construct International Measures of Unemployment, in *International Labour Review*, October, 1932 and "Some Problems in the Construction of Index Numbers of Employment," in the *International Labour Review*, April, 1934 and "Some Recent Censuses or Estimates of Unemployment," in the *International Labour Review*, July, 1933.

²⁸ For an interesting discussion of the difficulties involved in definition and the dependence of accurate statistics on precise definition see "Methods Used in Strike Statistics" by Florence Peterson in this JOURNAL, March, 1937.

²⁹ Shultz, W. J., "American Public Finance and Taxation" (New York, 1938), Chapter 14.

middle of April, resulting, therefore, in a concentration of Easter shopping in the first two weeks in April.

James J. Davis in a speech entitled "Every Six Minutes a Man is Killed" made the following astounding statement:

Many an American youth believed that his life was to be cut off prematurely when the government called him to the colors in 1917 to fight for his country. The fact was that he was really in less danger while fighting for the land that bore him than he was while engaged in his peaceful vocations. Fifty-three thousand-three hundred American soldiers were killed or died of wounds during the nineteen months of our participation in the War, victims of every refinement of modern slaughter; yet during that same period 132,000 persons were killed at home in the performance of the tasks of

Had Mr. Davis compared the percentage of deaths to the total exposed to death in the trenches to the percentage of deaths of the total exposed to death at home, he would probably have been somewhat chagrined at the result.

A similar instance of the use of absolute numbers where percentages should be used is found in the numerous attempts to disprove the Marxian thesis of the disappearance of the middle class by showing the growth in the actual number of small commercial establishments over several decades.

The opposite error of using percentages when the citation of exact figures would be more revealing occurs quite frequently. Professor Chaddock cites the classic example. A short time after Johns Hopkins University had opened certain courses in the University to women, it was reported that $33\frac{1}{3}$ per cent of the women had married into the faculty. Investigation revealed that only three women had attended the courses.³¹

Very often a percentage is calculated incorrectly³² or an incorrect base is used and a valueless relationship is offered for public consumption. New York Stock Exchange figures on short interests are stated as a per cent of the total shares of a company. The importance of short interest, however, lies in relation to normal volume of shares traded in on the Exchange. Stated in the first way the percentages indicating short interest customarily range from one-quarter of one per cent to two and a half per cent. Stated in the second way they customarily range from 30 to 200 per cent. There is an obvious reason for using the first method.³³

³⁰ *New York Herald Tribune*, January 2, 1927.

³¹ Chaddock, R., *Principles and Methods of Statistics* (New York, 1925), pp. 13-4.

³² For numerous examples of this see Croxton, F. E. and Cowden, D. J., *Practical Business Statistics* (New York, 1937), Chapter 7.

³³ *The New York Times*, August 9, 1938

An average is a measure of central tendency. Where there is no central tendency the use of an average is completely misleading in that it conceals divergent trends. Professor Spahr points out that the index number of prices (a type of average) in Sweden has been remarkably stable to the delight of the advocates of a managed currency. This apparent stability, however, up to the time at which he wrote had been due to the combination of rising prices of imported goods with the falling prices of agricultural products grown at home.³⁴

An average is likewise a summary picture of a total situation. Frequently, however, we are more interested in the parts than we are in the whole, and a summary picture is misleading. *The Guaranty Survey* goes to great statistical lengths to prove that the railroads as a whole are not overcapitalized. The figures presented in proof are, of course, average figures.³⁵ But, as Professor Edwards declares, in the case of certain specific roads there has been and is overcapitalization.³⁶ And we are concerned with specific roads. One-third of the railroad mileage of the country is in bankruptcy. Because the solvent two-thirds balances the bankrupt one-third on the average, we are asked to disregard the one-third and assume that what is true on the average is true of the whole and its parts.

In his recent study advocating economic nationalism, Jerome Frank attempts to show the unimportance of our foreign trade by pointing to the fact that our exports, for decades have never exceeded 7 per cent of our annual production of goods and services. The percentage is so small therefore that we may easily readjust ourselves to eliminate it. Now this figure is a type of average and as such it conceals much. Although at no time have we exported more than 7 per cent of our total goods and services we quite normally export approximately half of our cotton crop, 35 per cent of our tobacco crop, 25 per cent of our wheat, etc. The loss of our foreign markets would involve considerable readjustment in certain specific industries, a readjustment of which the 7 per cent Frank cites gives little indication.³⁷

Finally it may be shown that averages under certain circumstances may indicate a trend that is not at all true of the tendency of the components. Thus Kuczynski cites an instance where the average wage of a group as a whole may increase while the wage of each individual worker decreases.³⁸ He assumes that a factory employs 1,000 workers

³⁴ Spahr, W. E., *The Monetary Theories of Warren and Pearson* (Farrar and Rinehart), Pamphlet No 1, p. 15.

³⁵ "Railroad Finances and Business Recovery," *The Guaranty Survey*, January 31, 1938, p. 3.

³⁶ Edwards, G. W., *Evolution of Finance Capitalism* (New York, 1938), Chapter 15.

³⁷ Frank J., *Save America First* (New York, 1938).

³⁸ Kuczynski, Jurgen, *Labour Conditions in Western Europe* (London, 1937), p. 16.

of whom 200 are key men and receive a wage of 50 shillings a week while the remaining 800 receive 20s per week. The average wage is thus 26s per worker. During a crisis the 200 key men are retained but 600 of the remaining workers are laid off. Wages for all workers are cut 20 per cent thus giving the 200 key men 40s per week and the 200 ordinary workers 16s per week. The average wage is now 28s. While this is undoubtedly an exceptional case it may well serve as a warning of the distortion to which averages are subject.

The bias introduced in an index number by faulty weighting or by non-weighting has seldom been used to mislead. The danger is considered at length in every elementary text and statisticians have been quick to point out and others to correct violations.³⁹ The arbitrary selection of whatever base period is most suitable to the purpose at hand has, however, become a commonly recurring and widely used method of distortion of late. Where absolute numbers are employed it becomes a matter of selecting the most advantageous period on which to base the comparison and the misuse involved resembles types previously described.

The American Federation of Labor throughout 1935 and 1936 pointed to the greater recovery in the index of production compared to the index of employment; to the sharper gain in profits than in wages, using as its base period in both instances either the previous year or the low point of the depression. The *New York Times* in an editorial lashed out against "these misleading comparisons and the false conclusions and false remedies based upon them." By using depression lows obviously, indices would show production rising more than employment and profits more than wages because during the depression production and profits had fallen much more than employment and wages. Using 1929 as the base year (Federal Reserve Board indices) production in 1932 was 53 per cent of that of 1929; employment 61 per cent. By February, 1936 the *Times* indicated, both indices stood at 79, thereby demonstrating the misleading nature of the American Federation of Labor's statistics. Factory payrolls in 1932 fell to 42 per cent of 1929 but corporation net income fell from \$8,100,000 to minus \$5,400,000,000. Therefore profits could rise much faster than wages and still be below wages as compared with pre-depression levels.

The United States Steel Corporation is a case in point. In 1935 the net

³⁹ See Fisher, Irving, *The Making of Index Numbers* (New York, 1927), and Mitchell, W. C., "The Making and Using of Index Numbers," Bulletin No. 656 (Reprint of Part I of Bulletin No. 284) U. S. Department of Labor, Bureau of Labor Statistics. The whole concept of index numbers has been questioned in *Horses and Apples* by Bassett Jones. See also "Some Basic Problems in Index Number Theory," by E. E. Lewis, in *Economic Essays in Honor of W. C. Mitchell*.

income of the corporation was about \$1,000,000, while payrolls were \$252,000,000. In 1929 the net income of the Corporation was \$198,000,000, and payrolls were \$420,000,000. So if by some miracle the company's net income and payrolls were now both to return to 1929 figures, the A. F. of L.'s statisticians would be able to point out that payrolls had risen only 66 per cent above those of 1935, while profits had increased 19,700 per cent.⁴⁰

Throughout the 1936 Presidential campaign New Deal orators uniformly pointed to economic progress under the Roosevelt Administration by comparing 1936 figures and indices with January or March 1933 data.⁴¹

Mr. Hoover protested against this practice.

Incidentally, the culmination of that era of great fear is the convenient starting point for all of the President's comparative statistics. He chooses the low point of quotation induced by their own actions. If he would go back a few months in 1932, before the great fear started, he would find that prices were 80 to 100 per cent higher than those he quotes. And they were in 100 cent dollars.⁴²

But the Democrats had no monopoly of this practice. The Republican National Committee widely circulated the information that "Food Costs Jump 40% in 3 Years." The increase in the cost of living under the New Deal was thoroughly publicized and the figures used by the Republican were July 14, 1936 retail prices compared with March 15, 1933 figures. The Democrats protested against this misuse. A headline in the *New York Post* for October 16, 1936 read,

REPUBLICAN BLAST AT COST OF LIVING IS PROVED
A DUD—PANIC FIGURES ARE USED AGAINST F.D.R.

Republicans were asked if they wished to return to the 1933 panic price level since they were using this as their base period. Democrats pointed out that although wholesale prices had risen since 1933 they were only 80 per cent of the 1926 level. All in all it was a weird demonstration of mutual hypocrisy.

Germany index numbers of wholesale prices and cost-of-living, are inaccurate. Wholesale prices have remained remarkably stable, in view of the trend in other countries and the cost-of-living index has risen only slightly, according to the official figures. The League of Nations Statistical Office accepts and reproduces the official index figures without any qualification.⁴³ Prices used in the computation of index numbers are the official figures fixed by the Price Commissioner. They are

⁴⁰ *The New York Times*, May 20, 1936.

⁴¹ For an excellent example of this practice see table entitled "Last Three Years of the Old Deal Compared with First Three Years of the New Deal" in *Philadelphia Record*, January 21, 1936.

⁴² Hoover, H., "The Agricultural Policies of the New Deal" speech at Lincoln, Nebraska, January 16, 1936.

⁴³ *Money and Banking, 1937/38*, League of Nations, Commercial and Central Banks (Geneva, 1938), Vol. II, p. 90.

maximum prices but the German press itself admits that they are generally exceeded. They are prices for goods of a quality which has become increasingly difficult to obtain. The shortage of foodstuffs and consumption goods forces the consumer to resort to more expensive qualities. The prices of the more expensive classes of goods, however, are not used at all in the computation of the official index numbers. In addition the cost-of-living index is unrepresentative because it is based on an inadequate and outmoded budget.

The American Commercial Attache sums up succinctly:

Little, if any, attention need be paid to the German statistics of the cost of living since the official index has long ago ceased to reflect the actual movement of retail prices and of its other component parts.⁴⁴

The interpretation of conclusions derived from the application of correlation technique almost inevitably leads the novice in the field of statistics into error and furnishes a fertile area for manipulation by partisans. Although in every field of statistical technique a detailed knowledge of the whole situation is essential for the avoidance of error, it is particularly necessary in the realm of correlation analysis because of the unfortunately widespread tendency to read unjustified conclusions into a coefficient of correlation.

High correlation may be due to pure chance or to purely mathematical qualities. Correlation is often held to establish a cause and effect relationship when as a matter of fact correlation demonstrates nothing but the existence of a relationship. Error in the use of correlation technique, therefore, arises when correlation, due to either chance or mathematical elements of the data, is held to be significant, or where the existence of high correlation is interpreted as evidence of a causal relationship.

Where there is no common-sense relationship whatsoever, correlation due to pure chance is usually recognized as such. Dr. George Marshall in an unpublished study at The Brookings Institution⁴⁵ correlated variations in the death rate of the State of Hyderabad from 1911 to 1919 with variations in the membership of the International Association of Machinists from 1912 to 1920 and obtained the very high positive correlation of .86. Obviously no one would attach any importance to the correlation. Certainly no one would assume a cause and effect relationship had been demonstrated.

⁴⁴ Miller, Douglas, *Annual Economic Review, Germany 1937*, U. S. Department of Commerce, p. 101; see also *Germany's Economic Situation at the Turn of 1937/38*, Reichs-Kredit-Gesellschaft (Berlin), p. 50; and, *Economic Conditions in Germany to March 1936* by E. C. D. Rawlins, Department of Overseas Trade, Great Britain, pp. 230-1.

⁴⁵ Cohen, M. R., "Reason and Nature" (New York, 1931) p. 92.

Where a relationship, however, is within the realm of logical possibility and where for the purposes at hand the demonstration of a causal connection is desired, a positive correlation will unfortunately probably be so interpreted. English statistics reveal three trends: the proportion of marriages contracted outside the Church of England has been increasing for many years; the average age of Britons at death has also been increasing and the divorce rate has been rising. Yule points out that there is a positive correlation between the increase in the proportion of marriages contracted outside the Church of England and the increase in the average age of death. Yet, he adds, no one supposes that there is a causal relationship and that a law prohibiting the solemnization of marriages in churches would have the effect of improving the longevity of the nation.⁴⁶ However, a Church of England publication points to the correlation between the increase in the proportion of marriages contracted outside the Church and the growth in the divorce rate and holds the former to be the cause of the latter. If this correlation were considered alone the assumption of the causal relationship might appear logical to many but is it any more logical than the assumption that because there is a positive correlation between the growth in the divorce rate and the increase in the average age at death the increase in the average age at death may be attributed to the diminution of nervous strain and the increase of peace of mind resulting from the greater ease in eliminating a nagging spouse?

Spurious correlation, due to purely mathematical factors and to the arrangement of data, frequently arises when there is really no correlation or results in the exaggeration of a legitimate correlation. The technical details involved need not detain us here.⁴⁷

Procedure involved in time series analysis rests on a firm foundation. Methodology is constantly being improved to iron out slight biases and imperfections. Forecasting, however, rests upon no such firm foundation and allows human frailties full play. While the statistical facts upon which the forecast is based may be perfectly accurate, the assumptions involved in the procedure are the weak element, even where they are considered and they are, more often than not, overlooked. The basic assumption is that what has been consistently true, or true on the average, in the past, will continue to occur, with measur-

⁴⁶ See Yule, G. U., *Theory of Statistics* (London, 1916) and Tippet, L. H. C., *Methods of Statistics* (London, 1937), p. 162.

⁴⁷ For an exposition of the mathematical nature of spurious correlation see Yule, *op. cit.* pp. 215-6; Elderton, W. P., *Frequency Curves and Correlation* (London, 1927), pp. 155-8; Crum, W. L. and Patton, A. C., *Economic Statistics* (New York, 1925), p. 257, and Ezekiel, M., *Methods of Correlation Analysis* (New York, 1930), pp. 319, 347. Instances of spurious correlation are found most frequently in education and psychology. See Garrett, H. E., *Statistics in Education and Psychology* (New York, 1926).

able limits of variation, in the future. In the early 1920's a statistically accurate population study forecast that the population of New York City would be 29,000,000 by the year 2000. As *The Nation*, with keen insight, remarked,

... the estimate rests on the assurance that New York is going on for years at the same rate and in the same direction as now—in other words, that it is not going to learn anything during the remainder of the century.⁴⁸

A forecast is nothing more than a conditioned guess and, where the forecast is represented as being practically fact, statistical technique is abused. A copper mining company, desirous of selling stock to a credulous public plotted its past five-year production on a semi-log chart, drew a line of trend and extended it three years, representing the figures for those three years as probable production. A publication, which had captured popular fancy, as many fads do, forecast its circulation for five years in the future on the basis of its first five years circulation and distributed the "facts" widely among prospective advertisers.

Secretary of State, Cordell Hull recently took up his pen in protest against what he termed an "amazing statistical performance." In a letter to John D. M. Hamilton he decried "the misleading use of trade statistics by the Republican National Committee."⁴⁹ The Republicans had circulated a pamphlet in the farm areas comparing farm exports and imports in 1932 and 1937. The figures for the latter year showed a large decrease in exports and a sharp increase in imports. This, it was stated, was the consequence of Secretary Hull's trade agreements program and it was more than implied that Secretary Hull did not have the farmer's welfare at heart. Hull replied that it was not the trade agreements program which was responsible for the changed trend of farm imports and exports but rather the 1936 drought. This, he held, had sharply reduced exports and had necessitated increased imports of farm produce.

The controversy is illustrative of a type of dispute that occurs quite frequently and gives rise to the charge of misleading use of statistics. The statistics are usually substantially accurate. Opinions differ as to causes responsible for the trend shown or as to conclusions that may be drawn therefrom. Another case in point is the recent controversy between Gardiner C. Means and Rufus S. Tucker. Utilizing charts showing that the most sensitive fourth of all the prices included in the Bureau of Labor Statistics index had fallen 65 per cent from 1929 to 1933, while the least sensitive fourth had fallen only 10 per cent, Means

⁴⁸ *The Nation*, November 7, 1923

⁴⁹ For reprint of the full text of the letter see *New York Times*, September 4, 1938

attempted to prove that "oligopolies" exercised such control over prices in some industries as to cause inflexibility and that one of the leading causes for the depression was the disparity which had developed between sensitive and insensitive prices.⁵⁰ Both men were in complete agreement as to the inflexibility of certain prices and the sensitivity of others. In fact Tucker showed that such a condition had existed in previous depression periods.⁵¹ The issue was joined on what caused the inflexibility of certain prices, Means claiming that conditions of monopoly were responsible while Tucker held that other factors affecting supply and demand, such as the proportion of immediate out-of-pocket costs to the value of the product, controlled. The *New York Times* declared:

Certain prices are more sensitive than others and have always been, and if a statistician wishes to show the course of insensitive prices by one line on a chart and the course of sensitive prices by another, there is no reason why he should not do so. But what his chart will prove when drawn is another question. Neither the statistician nor the readers of the chart have the right, for example, automatically to begin calling the insensitive prices "administered" prices. That is a point to be proved, not to be assumed.⁵²

Occasionally incorrect inferences will be drawn from valid data because all the factors in a given situation are not known or because they have been deliberately overlooked. To a considerable extent the misuses of statistics involve logical fallacies of this type akin to fallacious arguments of a non-statistical type, glaring examples of which may be found in advertising and in political and religious tracts.

Propagandists on the West Coast during the hysteria of the early twenties attempted to prove that Japan had been violating the Gentlemen's Agreement. They cited statistics on the number of Japanese arrivals in the United States (92,606). They made no mention of the statistics of departure (80,432). They neglected to point out that the figures on arrivals included those for the Hawaiian Islands; included a large number of merchants, clerks and students sent here temporarily; included all Japanese going to Europe via the United States; and included Japanese who had been in America before and as "former residents" had returned from short visits to Japan.

Space does not permit an elaboration of the topical classification. Numerous studies are available on the statistics of particular fields⁵³

⁵⁰ *Industrial Prices and Their Relative Inflexibility*, 74th Congress, 1st Session, Senate Document No. 13.

⁵¹ "The Essential Historical Facts About 'Sensitive' and 'Administered' Prices," in *The Annalist*, February 4, 1938.

⁵² *The New York Times*, February 11, 1938.

⁵³ For example see Mears, Eliot G., "The Foreign Trade Statistics of the United States," in this JOURNAL, September 1935, and also the interesting essays in *Statistics in Social Studies*, edited by S. A. Rice (Philadelphia, 1930).

but nothing of consequence has been noted on the misuse and misinterpretation of data in such fields. This is unfortunate because the detection of error, be it accidental or deliberate, is so much easier for one who is well versed in the technical detail of the universe from which the data is drawn and who is so thoroughly acquainted with the whole situation that a comprehension of all factors which may play a part is available without effort. Manifestly it is impossible for any one person to be expertly at home in all the diverse fields in which statistical technique is employed. Consequently a real elaboration along topical lines calls for cooperative effort on the part of specialists and the author would welcome suggestions toward this end.

How may the various types of errors described be avoided? A long list of rules might be presented but its value would be dubious. Those who deliberately set out to mislead and deceive will not be stopped by a few cautioning "don'ts." Those who are careless enough to accidentally misuse statistical technique are not likely to commit a long list of rules to memory. The continuous application of a large measure of common sense, caution and reasoning skepticism is by far the safest bulwark against error, for as Pearson once declared:

It can scarcely be questioned that when the truth or falsehood of an event or observation may have important bearings on conduct, over-doubt is more socially valuable than over-credulity.⁴⁴

Though statistics is no more likely to be discredited by misuse than medicine is by the activity of a few "quacks," the numerous attempts to mislead the public by manipulation must be regarded as an annoying reality. Legal and medical associations are alert to weed out malpractices and one may seriously consider whether statisticians as a group ought not to act similarly. The establishment of a committee of the Association for the purpose of informing members of instances where current attempts are being made to deceive and the devotion of a page or two in each issue of the *JOURNAL* to recording instances of error, might well be considered.

⁴⁴ Pearson, K, *Grammar of Science* (London, 1911), p. 54.

INTEREST AND DIVIDENDS IN THE BALANCE OF INTERNATIONAL PAYMENTS

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I

INTERNATIONAL payments of interest and dividends in 1929 were estimated at 11 per cent of the world international trade in merchandise.¹ In 1936 such payments were estimated at slightly over 12 per cent of the merchandise trade. While much smaller in dollar volume than the merchandise trade, interest and dividends are definitely second in size among the trade and service items in the balance of international payments.

An analysis of the data relating to the interest and dividend account in balances of international payments is desirable for several reasons: first, because of the statistical importance of the account; second, because of the absence of any detailed analysis of its behavior; and third, because of the interest in its recent trends and the need for some well-founded conclusions thereon. In the course of the analysis the following questions should be answered: To what extent is the interest and dividend item controlled by the capital account? Do interest and dividend payments and receipts bear any close relation to any other item or items in the balance of payments? What are the characteristics of the payments and receipts as determined by the parts into which they may be divided? What is the relation of the conclusions thus drawn to the practical problems of today?

The following discussion is based primarily on an analysis of the data relating to the balance of international payments of Canada and the United States. These two countries provide us with balances of payments of two distinct types: first, the balance of payments of a debtor country, and second, one of a creditor country with an excess of merchandise exports. Some data are also used from the balance of payments of the United Kingdom, a creditor country with an excess of merchandise imports, while occasional use is made of data regarding other countries.

II

In the Canadian balance of international payments in 1936, interest and dividend receipts comprised 6.4 per cent of the total trade and service debit (payments) items, while the payments comprised 20.5

¹ League of Nations, *Balances of Payments*, 1936, p. 36.

per cent of the credit (receipts) items.² In 1929 the corresponding percentages were 3.1 and 18.2. The debtor position of Canada is clearly revealed by these figures. Furthermore, they emphasize the fact that interest and dividend payments by Canada did not decline nearly as much from 1929 to 1936 as did the other types of trade and service transactions. (See Table I.)

TABLE I
INTEREST AND DIVIDEND RECEIPTS AND PAYMENTS IN THE BALANCE OF
INTERNATIONAL PAYMENTS OF CANADA AND THE UNITED STATES

Year	Receipts as a percentage of trade and service imports		Payments as a percentage of trade and service exports	
	Canada	United States	Canada	United States
1929	3 1	14 0	18 2	5 6
1930	3 6	17 7	25 3	5 1
1931	4 3	19 2	30 5	3 5
1932	4 3	19 2	33 7	2 7
1933	4 7	21 1	31 2	4 1
1934	5 8	19 4	25 8	4 2
1935	6 0	17 0	22 2	5 3
1936	6 4	15 4	20 5	6 7

Sources Calculated from data given in Canada, Dominion Bureau of Statistics, *The Canadian Balance of International Payments, 1929-1936*, Ottawa, 1937, and in U S Department of Commerce, *The Balance of International Payments of the United States*

In the 1936 balance of international payments of the United States, interest and dividend receipts were equal to 15.4 per cent of all trade and service export (credit) items, while the payments were 6.7 per cent of the import (debit) items. The corresponding 1929 figures were 14.0 per cent and 5.6 per cent. These data reveal very definitely the net creditor position of the United States. Receipts of interest and dividends, while not conforming entirely to the trend of the other service items, revealed greater flexibility than the Canadian payments. The United States payments conformed to the general trend of the trade and service items to a high degree, if allowance is made for certain inaccuracies in the basic data (see footnote 4). These agreements and disagreements with the trend will be identified later in this article through a study of the relative size of the various types of investments from which the income is derived.

Available data regarding the balance of payments of the United Kingdom do not permit comparisons similar to those made relative to Canada and the United States. It will have to suffice to compare interest and dividend receipts with merchandise imports. In 1936 such receipts in the United Kingdom were 23.0 per cent of the imports, and in 1929, 20.8 per cent. Interest and dividend receipts in 1936 and 1929

² These comparisons of interest and dividend receipts with trade and service payments, and vice versa, were adopted on the theory that the volume of the latter provides the usual means for the transfer of the former. Gold is included among the Canadian trade and service items.

in the United States were, respectively, 23.4 and 22.3 per cent of imports and in Canada were 12.0 and 4.7 per cent. United Kingdom payments of interest and dividends in 1936 and 1929 were apparently insignificant, while in the United States they amounted, respectively, to 9.7 and 7.9 per cent and in Canada to 32.4 and 26.6 per cent of merchandise exports (excluding gold). The net creditor position of the United Kingdom is very evident from these figures.

These data should be sufficient to set in bold relief the different places which interest and dividend receipts and payments occupy in the balance of international payments of these countries. They also demonstrate further the statistical importance of the interest and dividend account.

III

In its long-term variations, the interest and dividend items are undoubtedly controlled very considerably by the capital movement. A country which is a net exporter of capital for new investment is building up a capital fund from which larger receipts may be expected. On the other hand, a country which year after year is importing foreign capital is building up a large debt and the yearly payments for the use of that capital may be expected to increase. The extent to which those larger receipts or payments materialize is, of course, affected by such factors as the long-term trends of money rates and the success or failure of the investments. The steady rise from 1865 to 1914 of payments by the United States on foreign investments and the steady rise of receipts from 1900 to 1929 bear out the long-term dependence of the interest and dividend item on the capital movement.

The short-term variations of interest and dividends do not seem to be closely connected with the capital account. Reference to the facts relating to several countries will demonstrate this statement. Table II shows the trend of investments and interest and dividends in Canada from 1928 to 1936, inclusive. Payments reached a low point in 1933, while foreign investments in Canada in that year were higher than at the beginning or the close of the period. Furthermore, although the two indices relating to investments in Canada and payments thereon corresponded in general trend through 1934, they did not correspond as to the extent of the change, and were exactly contrary in trend in 1935 and 1936. On the receipts side of the Canadian account, interest and dividends varied from 123.9 in 1928 (1926-1927 = 100) to 91.3 in 1933 and 178.5 in 1936—an 87.2 point range. Canadian investments abroad only had a 6 point range—111.1 in 1928, 109.5 in 1933 and 115.5 in 1936. As shown in Table II, the annual fluctuations of the receipts and the investments do not correspond closely.

TABLE II
TREND OF FOREIGN INVESTMENT TOTALS AND INTEREST AND
DIVIDEND RECEIPTS AND PAYMENTS—CANADA

Year	(1926-7 = 100)			
	Foreign investments in Canada	Interest and dividend payments	Canadian investments abroad	Interest and dividend receipts
1928	107 6	110 2	111 1	123 9
1929	113 2	129 4	113 6	144.5
1930	119.2	140 0	115 3	139 3
1931	117 1	132 8	114 3	117.8
1932	115 2	121 2	110 8	92 3
1933	114.5	105 9	109 5	91 3
1934	115 4	107 4	112 0	129 7
1935	114 2	108 8	114 4	145 2
1936	113 2	124 7	115 5	178 5

Source: Calculated from data given in Canada, Dominion Bureau of Statistics, *The Canadian Balance of International Payments, 1926-1936*, and *British and Foreign Capital Invested in Canada and Canadian Capital Invested Abroad, 1926-1936*

Data regarding the interest and dividend receipts and payments of the United States and the respective investments are not sufficiently comparable throughout the period from 1928 to 1937 to warrant the construction of an index. The trends of the capital movements and the interest and dividends are so diverse, however, as to warrant general conclusions from the data. In Table III, the first and third columns, it is seen that United States long- and short-term capital was exported during 1928, 1929 and 1930, while in Table IV it is noted that interest and dividend receipts (credits) from foreign investments increased in 1928 and 1929 but declined in 1930. Since the latter year there has been an inflow of both long- and short-term capital, with a minor exception in 1933, and, while receipts declined through 1932, they have risen rapidly ever since directly contrary to the capital trend.

TABLE III
CAPITAL MOVEMENTS IN THE BALANCE OF INTERNATIONAL PAYMENTS
OF THE UNITED STATES, 1928-1937
(Millions of dollars)

Year	Long-term capital movement		Short-term capital movement	
	Affecting United States invest- ments abroad	Affecting foreign investments in the United States	Affecting United States invest- ments abroad	Affecting foreign investments in the United States
1928	1,185	526	111	-115
1929	511	374	178	191
1930	328	61	185	-300
1931	-166	53	-563	-1,272
1932	-273	-56	-186	-595
1933	48	137	29	-383
1934	-185	-13	-106	86
1935	-118	344	-365	606
1936	-177	596	- 94	310
1937	-271	251	- 54	236

Source: U. S. Department of Commerce, "The Balance of International Payments of the United States," various years

Note: A minus sign (-) indicates a capital movement which tends to decrease the total investment in the category involved.

TABLE IV
INDICES OF CERTAIN ITEMS IN THE BALANCE OF INTERNATIONAL
PAYMENTS OF THE UNITED STATES, 1928-1937
(1928-7 = 100)

Year	Merchandise trade		Tourist expenditures		Interest and dividends	
	Exports	Imports	Credits	Debits	Credits	Debits
1928 . . .	106 0	95 0	110 9	108.3	116 4	131 0
1929 . . .	108 4	102 2	124 5	124.4	127.6	151.1
1930 . . .	79 4	71 1	108 8	115 5	119 4	109 5
1931 . . .	50 1	48 5	76 2	86 1	86 3	46 0
1932 . . .	33 3	30 7	48 3	87 6	60 1	24 8
1933 . . .	34 6	33 7	48.3	44 2	63 5	37 6
1934 . . .	44.1	38 4	58 5	50 2	64 3	46 0
1935 . . .	47 2	47 5	79 6	62 0	67 9	62 4
1936 . . .	50 8	56 3	94 6	75.3	74 1	86.9
1937 . . .	69 2	71 6	106 1	90 0	79 3	101 5

Source: Calculated from data given in U S Department of Commerce, *The Balance of International Payments of the United States*

Foreign long-term capital flowed into the United States almost continuously from 1928 to 1937 (Table III, columns II and IV), broken only by a small outflow in 1932 and 1934. Notwithstanding the large net inflow of capital, interest and dividend payments on the foreign long-term investments in the United States declined very sharply during the years from 1930 to 1932, inclusive. Of greater significance is the record of the three years, 1935-37, inclusive—during those three years \$1,191,000,000 (net) of long-term foreign capital was invested in the United States or 27 per cent of the total investments at the end of 1934, while interest and dividend payments rose from \$125,000,000 in 1934 to \$277,000,000 in 1937, an increase of 121 per cent.

Short-term foreign capital left the United States in large quantities from 1928 to 1933, inclusive, and the income therefrom declined even more sharply as a result of the decline in short-term rates. From 1934 to 1937 such foreign short-term funds increased \$1,238,000,000, but the income paid to foreigners remained at about \$1,000,000 throughout the four years because those funds were largely demand deposits upon which, by law, no interest could be paid.

The British experience has been quite similar to that of the United States. According to Sir Robert Kindersley's estimates³ British overseas investments amounted to £3,438,000,000 in 1929, £3,356,000,000 in 1932 and £3,414,000,000 in 1935—not a very decided change. The income from those investments, however, changed from £231,000,000 in 1929 to £156,000,000 in 1932 and £168,000,000 in 1935—fluctuations of considerable size compared with those of the investments. Still the fluctuations of income were relatively small compared with the experience of the United States because of the fact that Dominion issues comprise a larger part of the British investments than they do of those

³ Quoted in the *Economist* (London), November 20, 1937, pp. 360 and 361.

of the United States, and the Dominion issues were not in default to any considerable extent.

By glancing back over these examples of the lack of correspondence between capital movements and interest and dividend receipts and payments, several important facts become apparent. In the Canadian example (Table II), payments declined during the depression and then increased, but neither the decline nor the subsequent increase compared in scope with those shown by Canadian interest and dividend receipts. The reason was, of course, that foreign investments in Canada were composed of a much larger proportion of bonds (fixed interest bearing securities) than were Canadian investments in foreign countries. Furthermore, Canada did not default to any considerable extent on its bonded indebtedness. The income from direct investments and investments in common stocks is subject to wider fluctuations than bond investments.

This fact is given emphasis by the experience of the United States. The decline in interest and dividend receipts in this country was made more noticeable than the decline in Canadian payments by reason of the large number of defaults on foreign dollar bonds held, and by the repatriation of large quantities of foreign bonds. Although the decline in interest receipts in the United States has been continuous since 1930, the greater profitability of, and income received from, direct investments has caused total interest and dividend receipts to increase substantially since 1933. United States payments to foreigners have been affected by two circumstances: first, a large part of the foreign capital in this country is invested in common and preferred stocks which have received greatly increased dividends since 1933; and, second, there was a large inflow of foreign capital into the United States during those same years. The result has been an increase in payments, since 1933, even more rapid than that shown by receipts.

Tables IV and V show clearly that the interest and dividend receipts and payments of the United States conform, in general to the pattern set by the other items. Some of the differences in trend may be accounted for by changes in methods of estimating the various items.⁴ Through 1932 only one item departed widely from a common trend—interest and dividend payments (debits)—and that is explained above. In 1933, all of the items except tourist expenditures abroad (debits) turned slightly upwards. From 1933 on, interest and dividend receipts (credits) lagged, as a result of continued defaults on foreign bond hold-

⁴ For example, beginning in 1934 the estimates of interest and dividends paid (debits) were based on data received in the course of a special study. It is quite clear that the estimates for 1931, 1932 and 1933, which were not revised, are considerably too low. The estimates in 1928 and 1929 were, likewise, too high.

ings, and very substantial reductions in the par value of those holdings.

The extent to which interest and dividend receipts (credits) have lagged behind the other balance-of-payments items is shown in Table V. The influence of the income from the two types of investments is also shown. Income from portfolio investments—almost entirely interest—has declined steadily, while that from direct investments has increased. The failure of interest receipts to correspond in trend to the other items is typical. At the beginning of the depression they declined later and more slowly than the other items. Defaults did not start until 1931. The defaults stimulated to some extent the repatriation of foreign dollar bonds, so that the later resumption of partial or complete service did not have as great an effect on the total receipts as it would otherwise have had.

TABLE V
INDICES OF CERTAIN ITEMS IN THE BALANCE OF INTERNATIONAL
PAYMENTS OF THE UNITED STATES, 1934-1937
(1934 = 100)

	1934	1935	1936	1937
Merchandise trade				
Exports	100	107 0	115 1	156 8
Imports	100	123 7	146 4	186 3
Freight and shipping.				
Credits	100	103 3	111 5	175 4
Debits	100	103 1	134 4	218.7
Tourist expenditures.				
Credits	100	136 0	161.6	181.4
Debits	100	123 6	150 2	179 5
Interest and dividends				
Credits—total	100	105.7	115 2	123.3
Direct	100	133 3	158 3	183 3
Portfolio	100	87.4	81 9	73 5
Debits—total	100	135.7	188 9	220.6

Source: Calculated from data given in U S Department of Commerce, *The Balance of International Payments of the United States*

The resumption of service on defaulted bonds often awaits a considerable and apparently stable improvement of business. Without a resumption of service, new loans, except those where the government of the lending country is the guarantor or the lender, are very limited in volume. The result is that both the income from, and the volume of, the portfolio investments tend to lag several years behind the other items. Income from direct investments, on the other hand, has shown a trend closely corresponding to the other items in the balance of payments (see Table V). It is shown to be largely a reflection of business trends influenced to some extent by changes in exchange rates and by exchange restrictions. The trend of income from direct investments has been very similar to merchandise imports and tourist expenditures in foreign countries. There may be a rather direct connection between merchandise imports and income of this type because a large part of

the direct investments are in raw material industries and a large part of our imports are in the raw material category.

Interest and dividend payments (debits) increased more than the other items. Being largely dividends on common and preferred stocks, the payments are dependent to a considerable extent on prosperity of business. If that were the only factor, the increase should have been more nearly equal to that of imports and exports. The other factor was, of course, the large purchases of United States securities by foreigners, particularly since 1934. These large investments were dictated by political as well as economic considerations, and to the extent that political considerations were dominant the trend of the resulting income item would be different than that of other items not similarly affected.

TABLE VI
INDICES OF CERTAIN ITEMS IN THE BALANCE OF INTERNATIONAL
PAYMENTS OF CANADA, 1928-1936
(1928-7 = 100)

Year	Merchandise		Freight		Tourist		Interest and dividends	
	Export	Import	Credit	Debit	Credit	Debit	Credit	Debit
1928 .	109.0	116.7	99.3	107.4	125.2	103.4	123.9	110.2
1929 .	95.8	124.0	94.5	121.4	140.8	117.3	144.5	129.4
1930	71.4	96.4	72.8	94.5	127.0	96.8	139.3	140.0
1931...	49.1	60.0	56.0	73.3	114.1	73.7	117.8	132.8
1932 .	39.8	43.2	39.3	61.4	96.6	55.4	92.3	121.2
1933	42.6	38.3	45.2	61.4	53.3	49.1	91.3	105.9
1934	52.3	49.0	53.2	73.8	66.4	61.3	129.7	107.4
1935	58.8	52.5	70.6	76.6	97.7	88.3	145.2	108.8
1936 ..	75.8	60.6	83.0	91.2	116.4	96.2	178.5	124.7

Source Calculated from data given in Canada, Dominion Bureau of Statistics, *The Canadian Balance of International Payments, 1928-1936*

Important items in the balance of international payments of Canada show a striking lack of uniformity in trend (see Table VI). Interest and dividends were the only item to show an increase in 1936 over 1928—44 per cent for receipts and 13 per cent for payments. These percentage relationships emphasize the varying trends of the returns from different types of investments. Most of the Canadian investments abroad are of the direct type, or are holdings of common stocks (equities), both of which are subject to widely fluctuating returns. Foreign investments in Canada include a large percentage of bond holdings the returns from which usually decline during and after a depression. The slight increase in total payments resulted entirely from the increased payments on direct investments. Merchandise exports declined 30 per cent during the same period, imports 48 per cent, freight receipts 16 per cent, and freight payments 15 per cent, and tourist expenditures, both receipts and payments, 7 per cent. The general direction of the fluctuations of the different items corresponded with a year's lag here and there, but the amplitude of the fluctuations differed widely.

The British balance of payments was more nearly similar to that of the United States than that of Canada. The range of fluctuations was not as great as that of either of the latter countries (see Table VII). To be sure, the British figures, except those of exports and imports, were net, but in both shipping and interest and dividends the deductions from gross receipts were relatively quite small and would have but little effect on the result. Interest and dividend receipts did not decline as far as the other items during the depression and have since risen higher. The fluctuations, in both direction and volume, corresponded more closely to those of net shipping income than to those of the merchandise trade.

TABLE VII
INDICES OF CERTAIN ITEMS IN THE BALANCE OF INTERNATIONAL
PAYMENTS OF GREAT BRITAIN, 1928-1936
(1926-7 = 100)

Year	Merchandise		Net shipping income	Net interest and dividends
	Exports	Imports		
1928	104 8	97 3	100	100
1929	104 2	99 2	100	100
1930	81 8	64 9	80 8	88
1931	56 6	70 2	61 5	68
1932	51 8	57 3	53 8	60
1933	51 9	55 3	50 0	64
1934	56 5	60 8	53 8	68
1935	65 8	64 3	57 7	72
1936	63 8	69 9	73 1	78

Source Calculated from data given in the League of Nations Memoranda on, *Balances of Payments*

The varying trends of the returns from the different classes of investments have been noted at several points of this discussion, which related to individual countries. The principal division made has been that between interest and dividends. Still further general divisions of dividend returns may be made. First, there are the returns from the foreign direct investments of the United States. Such investments involve the control of foreign enterprises and the typical form of return is dividends paid out of earnings. This division may be subdivided into, (1) the returns from raw-material-producing enterprises which are subject to and very sensitive to price changes; (2) the returns from manufacturing enterprises which are less sensitive, and (3) the returns from public utility enterprises which do not change rapidly nor widely. Second, there are the dividends paid on miscellaneous holdings of common and preferred stocks such as form so large a part of foreign long-term investments in the United States. Covering relatively small holdings in a wide range of enterprises, the returns from this group, as a whole, fluctuate less than those from some types of direct investments but far more than the interest from bonds.

IV

It is evident by this time that the dividend payments and receipts are affected by the same factors which affect other trade and service transactions and only slightly by capital movements, whereas interest payments and receipts are quite closely related to capital. It is evident, also, that other service items are not solely dependent on the forces which affect trade. Freight and shipping charges, for example, are related to rates as well as to the volume and value of foreign trade. Immigrant remittances and charitable contributions are related to the need for assistance as well as to the ability to give it. It is a mistake to think that merchandise trade, because of its volume, governs or marks the proper course of the other items. Each series of items is dependent upon a separate combination of factors and each must in most cases be considered separately.

Some students have suggested that in the physical arrangement of the balance-of-payments data, the interest and dividend account should be excluded from the service items.⁵ This exclusion of interest and dividends from the service items has been supported largely by the argument that interest and dividends are governed by contractual relations, whereas the trade and other service items are dependent upon business conditions. The preceding analysis has shown that that argument is only partially true, that is, as to interest payments and receipts only. It represents a generalization based on the impression in many people's minds that the foreign investments of the United States and of other countries are largely interest-bearing obligations. This impression has tended to belittle the importance of direct investments and portfolio holdings of common stocks which have comprised over half of the total foreign private long-term investments of the United States throughout its history and an important part of the foreign investments of other creditor countries.

In 1934, the returns from direct investments (dividends) comprised over half of the total interest and dividend receipts of the United States. In 1937, they comprised over 72 per cent of the total receipts. On the payments side, returns from direct investments, plus dividends on common stocks, have, in recent years, comprised over 80 per cent of total payments of interest and dividends by the United States. The facts regarding most countries would tend to de-emphasize interest payments and receipts and increase the emphasis on dividend pay-

⁵ *International Economic Relations*, Report of the Commission of Inquiry into National Policy in International Economic Relations, pp. 136-7. University of Minnesota Press, 1934.

ments and receipts. Only in certain cases, however, do direct investments occupy a relatively minor position.

Narrowed down to the interest item, there might be some justification for excluding it from the trade and service group, because of the contractual relationship, providing that the other trade and service items were themselves governed by identical combinations of forces. Inasmuch as they are not so governed, each being peculiar unto itself, and governed by different sets of circumstances, the argument, even as it relates to interest, breaks down. Unless one is prepared to advocate that no grouping of balance-of-payments items is desirable, it seems necessary to admit that, for general purposes, the interest and dividend account may logically be classed with the service items. For purposes of special analyses any of them may be separated from the others.

V

What practical conclusions may be drawn from this analysis? The first conclusion follows from the fact that dividends form an important part, statistically, of the interest and dividend item and that dividends are subject to fluctuations which are very similar in volume and direction to those noticed in the other items. This being true there would not seem to be any great hardship placed on the balance of payments of a country by reason of the necessity for transferring dividend payments during a depression,⁶ during which time they would naturally be greatly reduced in volume, and would require no greater proportion of the exchange assets than in times of prosperity.

The second conclusion follows from the first and from the experience of various countries. In other words, interest payments (exclusive of dividends), even though somewhat inflexible in volume, do not comprise by themselves a very large part of the trade and service items of the balance of payments, and only occasionally is the burden on the exchange resources of a country sufficiently heavy to justify defaulting on interest payments.

It is not possible to separate interest from the returns from direct investments in the balance of payments of most countries so that, in judging the validity of that conclusion by the experience of other countries, it will be necessary to compare the entire interest and dividend burden with the other balance-of-payments items. That is done in Table VIII.

⁶ There are, of course, several conflicting tendencies at work at such times. Some imports and services are occasionally of more pressing importance than others—imports of military supplies, for example. On the other hand, foreign investments may be yielding a large part of the foreign exchange available for paying for such imports and services.

TABLE VIII
INTEREST AND DIVIDEND PAYMENTS AS A PER CENT OF TOTAL TRADE
AND SERVICE CREDIT ITEMS,* 1929 AND 1935

Country and Default Status	1929	1935
Argentina (defaults small)	22 0	27 0
Australia (no defaults)	25 2	31 5
Canada (defaults insignificant)	18 2	22 2
Czechoslovakia (defaults small)	4 5	18.3
Germany (defaults almost complete)	8 0	11.1 (23 5)
Hungary (defaults complete). . .	14 4	5 8 (37.7)
Japan (no defaults)..	4 4	3 9
Norway (no defaults)	6 2	7 5
Poland (no defaults through 1935)	10 9	12.5

Note Figures in parentheses represent the 1929 interest and dividend payments as a per cent of 1935 total trade and service credit items.

Source Calculated from data present in the League of Nations Memoranda on *Balance of Payments*

* See footnote 2, *supra*.

The data in Table VIII indicate that some countries which did not default on their foreign obligations had heavier burdens to bear than others which did default. In several of these cases the debt service burden increased considerably from 1929 to 1935. In other countries which did not default the debt burden increased but little. The most evident conclusion to be drawn from these data and from the general considerations given earlier in this article, is that defaults are in many cases more psychological and political than economic phenomena. In other words, certain countries, where the economic justification for defaulting on their foreign obligations seemed most clear, chose rather to serve those obligations in full, while other countries, which had much less economic justification, chose to default in whole or in part. Definite conclusions on this point cannot be drawn on the basis of percentages. Other factors, such as the character of the other debit and credit items, must be considered.

By way of summary, it may be noted, first, that the interest and dividend item is dependent upon capital movements in its long-term trends but is relatively independent in its short-term trends. Second, the returns from direct investments and dividends on common stocks fluctuate in rather close conformity with the prosperity of business and are very similar in volume and direction to the fluctuations of other items in the balance of payments. Third, a comparative study of the balance of payments of several countries indicates that, in some cases, the justification for defaults is not entirely an economic one.

SEASONALITY IN STRIKES

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THAT there is a pattern of seasonal variation in strikes in the United States is suggested by even the most cursory examination of the monthly data representing such disputes. In the recent study of "Strikes in the United States, 1880-1936,"¹ the author observes that, "In general, the smallest number of strikes occur during the winter months from November through February. . . . Strikes begin to increase in the spring, especially in May, and remain at a relatively high level all summer. . . . About the same seasonal characteristics pertain to the number of workers involved in strikes. . . . In general, the number of man-days idle because of strikes increases each spring and summer and is lowest during December and January."

The general pattern of seasonality thus broadly described is clearly evidenced in the data of Table I, which summarizes the numbers of strikes beginning in each month from January, 1927 through December, 1936. It may be observed that the average number of disputes per month throughout this period varies from a low of 59.8 for December to a high of 132.6 in August and a similarly large average of 131.6 for May. December, November, February, January, March, and October, in the order mentioned, have lowest averages. August, May, September, April, July, and June, in that order, have highest averages.

TABLE I
NUMBER OF STRIKES BEGINNING EACH MONTH, JANUARY, 1927
THROUGH DECEMBER, 1936

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1927	35	63	70	84	95	80	55	56	58	50	28	33	707
1928	45	46	41	69	80	44	56	53	48	60	37	25	604
1929	50	51	68	121	121	77	81	86	99	73	60	34	921
1930	49	49	47	68	58	61	79	53	68	42	36	27	637
1931	58	52	53	78	104	66	67	78	81	68	57	48	810
1932	88	60	63	89	91	74	72	89	86	50	43	36	841
1933	83	67	106	89	161	154	237	261	233	145	87	72	1695
1934	98	94	161	210	226	165	151	183	160	187	130	101	1856
1935	140	149	175	180	174	189	184	239	162	190	142	90	2014
1936	167	148	185	183	206	188	173	228	234	192	136	132	2172
Total	813	779	969	1171	1316	1098	1155	1326	1219	1057	756	598	12257
Mean	81.3	77.9	96.9	117.1	131.6	109.8	115.5	132.6	121.9	105.7	75.6	59.8	

¹ Florence Peterson, "Strikes in the United States, 1880-1936," Washington, Bureau of Labor Statistics, 1938 (Bulletin 651).

For the period as a whole, strikes beginning in the month appear to be relatively infrequent in early months of each year, to increase rapidly in April and May, to decline slightly in June and July, to increase again in August and September, and then to decline through November to the lowest point in December.

In the period represented by Table I, however, there is considerable variation in the numbers of strikes within each of the months. The months do not occupy the same relative positions throughout all the years. The month-to-month variation is not, in other words, perfectly consistent, so that there may be question whether the seasonal pattern is sufficiently marked to be really significant. In other words, there may be a question whether that pattern is sufficiently distinctive so that differences among the months and among the averages for these months cannot be explained by mere chance variability.

If the seasonal pattern is significant, if the apparent differences cannot be explained by chance, the raw data of strikes can be made more meaningful by reference to measured seasonal fluctuation. If strike data were so adjusted, numerous comparisons with other adjusted series representing changing business and economic conditions might be facilitated. The possible importance of such comparisons is suggested by the fact that the data of strikes represent almost the only quantitative index of industrial unrest throughout the nation.

There are several continuing series describing the frequency and extent of strikes in the United States. All of them are maintained by the Bureau of Labor Statistics and are released regularly in the *Monthly Labor Review* and in frequent special bulletins. The two most extensive series are those that describe the number of strikes beginning in each month and the numbers of workers involved in these strikes. Continuing series of monthly data for the number of strikes have been maintained since 1915, and annual totals are available for the period since 1914. For earlier years, only discontinuous reports are available. In the monthly data of strikes "beginning in the month" from 1915 to 1926, possibly 10 per cent of the strikes are of unknown monthly origin, so that the data for these years are not satisfactory as indicating seasonality. Since 1927, however, the monthly origin has been accurately recorded, and additional information has been secured, so that present series describe not only the number of strikes beginning in the month, but also the numbers ending in each month, the number in progress during the month, numbers of workers involved

in these strikes, and man-days of idleness occasioned by them.²

Most reliable monthly data are thus restricted to the period since January, 1927. It is proposed here to examine some of those data to appraise the reality and significance of a seasonal pattern in them. Attention is particularly directed to the series describing the number of strikes beginning in each month, since items of that series enjoy a degree of independence that is not characteristic of some of the other data, especially those describing the numbers of strikes in progress during the month.

TABLE II
CALCULATION OF THE CRITICAL RATIO, d/σ_d

Data: see Table I.

January X	December Y	Difference $X - Y = G$	G^2
35	33	2	4
45	25	20	400
50	34	16	256
49	27	22	484
58	48	10	100
88	36	52	2704
83	72	11	121
98	101	-3	9
140	90	50	2500
167	132	35	1225
Total 813	598	215	7803
Mean 81.3	59.8		

$$d = 81.3 - 59.8 = 21.5$$

$$\Sigma G^2 = \Sigma G^2 - (\Sigma G)^2/n = 7803 - 4622.5 = 3180.5$$

$$\sigma_G^2 = \Sigma G^2/n = 3180.5/10 = 318.05; \sigma_G = 17.82$$

$$\sigma_d^2 = \sigma_G^2/(n-1) = 318.05/9 = 35.339; \sigma_d = 5.94$$

$$d/\sigma_d = 21.5/5.94 = 3.6$$

A preliminary approach to the question of the significance of seasonality has been made by comparing the differences between monthly averages, indicated in Table I, with the standard errors of these differences. The so-called "critical ratio," d/σ_d , has been calculated for each of the paired monthly averages. Because there is some positive correlation between the items of each pair of months (due to different yearly levels of strikes), the method of "gains" has been used in calculating the critical ratios. The procedure is illustrated in Table II, and the resulting critical ratios are summarized in Table III.

² For details as to available data see Florence Peterson, *op cit* and "Methods Used in Strike Statistics," this JOURNAL, 32, (1937), 90-96, Paul H. Douglas, "An Analysis of Strike Statistics, 1881-1921," *ibid.*, 18, (1923), 866-877; H. M. Douty, "The Trend of Industrial Disputes, 1922-1930," *ibid.*, 27, (1932), 168-172; A. H. Hansen, "Cycles of Strikes," *American Economic Review*, 11 (1921), 616-621.

TABLE III
CRITICAL RATIOS, d/σ_d , FOR MONTHS, 1927-1936

Data* see Table I.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Jan	—	71	1 93	2 38	4 37	3 12	2 33	2 90	2 92	2 16	.85	3.65
Feb	71	—	2 60	4 04	5 02	3 58	2 40	2 86	2 75	2 43	36	3 20
Mar	1 93	2 60	—	2 97	5 13	3 12	1 40	2 46	1 90	1.54	3 93	5 00
Apr	2 38	4 04	2 97	—	1 96	.74	09	78	.27	1 17	6 00	6.25
May	4 37	5 02	5 13	1 96	—	2 99	1 21	07	.76	4 15	8 12	8 77
June	3 12	3 58	3 12	74	2 99	—	60	1 98	1 19	.77	5 37	2 81
July	2 33	2 40	1 40	09	1 21	60	—	2 12	.89	88	3 14	4 03
Aug	2 90	2 86	2 46	78	07	1 98	2 12	—	1.20	2 34	3.56	4 04
Sept	2 92	2 75	1 90	27	76	1 19	89	1 20	—	1 40	3 44	4 67
Oct	2 16	2 43	1 54	1 17	4 15	77	88	2 34	1 40	—	4 35	4 56
Nov	85	36	3 93	6 00	8 12	5 37	3 14	3 56	3 44	4 35	—	3 10
Dec	3 65	3 20	5 00	6 25	8 77	2 81	4 03	4 04	4 67	4 56	3.10	—

For ten variables, the one per cent level of significance for such critical ratios is somewhat greater than three standard errors, being approximately 3.25. The 5 per cent level is approximately 2.26. Twenty-one of the 66 inter-month critical ratios are above the one per cent level, and 18 additional ratios are above the 5 per cent level. It would appear, therefore, that there are significant seasonal differences.

As a further test, however, the data of Table I have been subjected to dual variance analysis. The procedure is not unusual in any respect, having been used for similar purposes in numerous other connections.³ It is presented in summary form in Table IV. Major steps in the process may be outlined as follows: (1) Totals for all items in Table I and for their squares are first noted and designated $\sum Y$ and $\sum Y^2$, respectively. These totals are 12,257 and 1,660,688. (2) Individual column totals (designated $n_c M_c$, to indicate the number of items per column multiplied by the mean of the column) are then noted and totaled, as are their squares. The same manipulation is applied to row totals and their squares. The sum of squared column totals is designated $\sum n_c^2 M_c^2$, and the sum of squared row totals is designated $\sum n_r^2 M_r^2$. (3) These sums are divided by the number of items per column and per row respectively to obtain $\sum T_c^2$ and $\sum T_r^2$. (4) $\sum y^2$, the sum of the squared deviations in the whole table, is then found as $\sum y^2 - (\sum Y)^2/n$, and the values of $\sum T_c^2$ and $\sum T_r^2$ are reduced by the same centering correction to provide $\sum t_c^2$ (the total of squared devia-

* See G. R. Davies and Dale Yoder, *Business Statistics*, New York, John Wiley and Sons, Inc., 1938, pp. 406-425; T. W. Schults and G. W. Snedecor, "Analysis of Variance as an Effective Method of Handling the Time Element," this JOURNAL, 28 (1933), 14-30; F. C. Mills, *Statistical Methods*, New York, Henry Holt and Co., 1938, pp. 522-530

tions among the columns) and $\sum t_r^2$ (the total of squared deviations among the rows). (5) The residual measure of interaction, $\sum s^2$, is then directly available by subtraction as indicated. (6) The values thus obtained are divided by their appropriate degrees of freedom (for the whole table, $n-1$; for the columns, the number of columns minus 1; for the rows, the number of rows minus 1; and for the residual, $n-1$ minus the sum of those accorded columns and rows) to discover the corrected mean squares, as shown in the lower portion of the table (7) Values of F for column and row variance are then measured as ratios of the corrected mean squares of columns and rows to the residual mean square.

TABLE IV
SUMMARY OF VARIANCE ANALYSIS

Data: See Table I.

Column totals		Row totals	
$n_c M_c$	$n_c^2 M_c^2$	$n_r M_r$	$n_r^2 M_r^2$
813	660,969	707	499,849
779	606,841	604	364,816
969	938,961	921	848,241
1,171	1,371,241	637	405,769
1,316	1,731,856	810	656,100
1,098	1,205,604	841	707,281
1,155	1,334,025	1,695	2,873,025
1,326	1,758,276	1,856	3,444,736
1,219	1,485,961	2,014	4,056,196
1,057	1,117,249	2,172	4,717,584
756	571,536		
598	357,604	12,257	18,573,597
12,257	13,140,123		

ΣY (total of all items) = 12,257
 ΣY^2 (total of squares of all items) = 1,660,688
 $\Sigma T_c^2 = \Sigma n_c^2 M_c^2 / n_c = 13,140,123 / 10 = 1,314,012.3$
 $\Sigma T_r^2 = \Sigma n_r^2 M_r^2 / n_r = 18,573,597 / 12 = 1,547,799.75$
 $\Sigma y^2 = \Sigma Y^2 - (\Sigma Y)^2 / n = 1,660,688 - 12257^2 / 120 = 1,660,688 - 1,251,949.59 = 408,738.41$
 $\Sigma t_c^2 = \Sigma T_c^2 - (\Sigma Y)^2 / n = 1,314,012.3 - 1,251,949.59 = 62,062.71$
 $\Sigma t_r^2 = \Sigma T_r^2 - (\Sigma Y)^2 / n = 1,547,799.75 - 1,251,949.59 = 295,850.16$
 $\Sigma s^2 = \Sigma y^2 - (\Sigma t_c^2 + \Sigma t_r^2) = 408,738.41 - (62,062.71 + 295,850.16) = 50,825.54$

Corrected Mean Squares			
	Squares	Degrees of freedom	Mean squares
Whole table	$\Sigma y^2 = 408,738.41$	$n - 1 = 119$	—
Columns	$\Sigma t_c^2 = 62,062.71$	$n_c - 1 = 11$	5642.06
Rows	$\Sigma t_r^2 = 295,850.16$	$n_r - 1 = 9$	32872.24
Residual	$\Sigma s^2 = 50,825.54$	$(n - 1) - [(n_r - 1) + (n_c - 1)] = 99$	513.38

$F_c = 5,642.06 / 513.38 = 10.9$. The least highly significant value is 2.6.
 $F_r = 32,872.24 / 513.38 = 64.0$. The least highly significant value is 2.7.

When the values of F thus obtained are compared with chance expectancies, as the latter are indicated by the one per cent values noted in the table, it is apparent that variance in both columns and rows is highly significant, being many times that which might be expected by chance. The analysis effectively supports the conclusion suggested by the critical ratios to the effect that inter-monthly variation is far beyond mere chance expectancy.

TABLE V
RANKING CHI-SQUARE TEST APPLIED TO SEASONAL RELATIVES
Data Ratios to 12-month moving averages of the data of Table I.

Period	Rank of month in twelve-month period											
	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
1927-28	8	9	10	6	1	2	5	7	3	11	12	4
1928-29	9	8	5	10	2	1	4	3	6	12	11	7
1929-30	8	9	12	6	5	1	2	3	4	11	7	10
1930-31	11	7	9	3	2	1	6	5	4	10	12	8
1931-32	6	8	9	5	2	1	11	3	4	10	12	7
1932-33	8	12	11	4	2	1	7	3	6	5	10	9
1933-34	11	12	10	5	2	1	3	4	6	8	9	7
1934-35	6	12	5	11	2	1	3	4	8	9	7	10
1935-36	9	12	4	10	2	1	5	3	8	6	11	7
Total	76	89	75	60	20	10	46	35	49	82	91	69
Squares	5776	6241	5625	3600	400	100	2116	1225	2401	6724	8281	4761

$$\Sigma X = 702, \Sigma X^2 = 47,250$$

$$\Sigma x^2 = \Sigma X^2 - (\Sigma X)^2/n = 47,250 - 41,067 = 6,183$$

$$\chi^2 = 6 \Sigma X^2 / \Sigma x = 37,098/702 = 52.85 \text{ (The 1 per cent probability is 25)}$$

There remains the possibility that the data show such a well-defined, simple trend that the influence of the latter accounts for the differences between months. In order to appraise that possibility, two additional tests have been applied. In the first, seasonal relatives have been calculated for each of the months (as ratios to a twelve-month moving average), and dual variance analysis has been applied to these seasonal relatives. The use of the twelve-month moving average in this connection should effectively eliminate or greatly reduce the influence of the trend.

The procedure is not presented here in detail, since it is almost identical with that illustrated in Table IV. When the dual variance analysis is applied to the seasonal relatives, however, the value of F for inter-year variability is found to be 1.146. The five per cent value for F in this connection is 2.0, and the value found clearly evidences the effectiveness of the relatives in removing significant inter-yearly variation. The value of F for inter-month variability is, however, 14.095. The

one per cent chance value is 2.5. The result clearly indicates, therefore, that, with trend removed, the inter-monthly variability is many times the highly significant probability.

A final check on the foregoing conclusion is provided by the application of the ranking χ^2 test to the seasonal relatives. The method has been recently discussed in this JOURNAL,⁴ but the particular procedure used here involves a simplification suggested by Professor G. R. Davies. Table V summarizes the process. Its result indicates that the monthly pattern cannot reasonably be attributed to chance, since the one per cent value of χ^2 in this connection is approximately 25, while the actual value found is 52.83.

It would seem apparent, therefore, that there is a highly significant seasonal pattern in the data of strikes, a pattern that cannot be attributed to any trend or cyclical influences but appears in spite of all such influences. Under the circumstances, it would appear distinctly desirable that this seasonal pattern be recognized, so that normal month-to-month changes might not be mistakenly interpreted as indicating more fundamental or far-reaching movements. Moreover, since there is well-established use of seasonally adjusted data of numerous other series, it might be well to release strike data in similarly adjusted form.

As a step in that direction, seasonal indexes have been calculated from the data of Table I by ratio-to-moving average and median link relative methods. Crude moving average indexes have been calculated as means of the three central seasonal relatives for each month, and these crude measures have then been refined by expressing each as a ratio to their average. The indexes thus calculated are presented in Table VI.

TABLE VI
SEASONAL INDEXES OF STRIKES BEGINNING IN THE MONTH

	Link relative method	Ratio to moving average method
January	89.4	91.7
February	84.8	81.0
March	95.5	91.2
April	127.6	121.4
May	137.8	139.4
June	110.7	115.5
July	109.3	111.0
August	123.5	117.7
September	119.8	115.1
October	93.1	98.0
November	63.4	65.8
December	45.1	52.4

⁴ Milton Friedman, "The Use of Ranks to Avoid the Assumption of Normality Implicit in the Analysis of Variance," this JOURNAL, 32 (1937), 675-701.

POPULATION ESTIMATES OF LOCAL COMMUNITIES AND ECONOMIC PLANNING

BY GEORGE J. EBERLE
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THE GREAT importance of urban population estimates and particularly forecasts in economic planning is not generally appreciated. Over a period there is a definite relationship between the growth of the number of inhabitants and the expansion of private enterprises and governmental facilities. The need for various local utilities and public works; for housing, schools, shopping and recreational facilities; and for local service industries is definitely related to the population growth. To provide all these instrumentalities which involve capital items with lives extending over periods of twenty-five to fifty years, or longer, without overbuilding or underbuilding is a challenge to the ablest statistician and executive. The importance of the challenge is found in the fact that 56 per cent of our population resides in urban centers.

In our urban communities in the past there has been repeatedly a woeful lack of balance between demand and supply of these facilities and services. With proper intercensal estimates and postcensal forecasts of population growth and distribution as a guide, numerous losses through superabundance or inadequacy could have been partially or wholly avoided. In prognosticating economic needs in any community, for example, properly prepared and applied per capita data are of great assistance. Fairly definite future trends can be determined by past performance of representative per capita annual consumption of various classes of food, furniture, and clothing; of water, gas, electricity; of telephones per 100 families; of persons per automobile; of electric railway or bus rides per capita; of persons per classified retail outlet; of various levels of income and buying power per capita; of square feet of office space per person; of hospital beds per 1000 persons, etc. Comparative studies can be made to detect undersaturation, oversupply and future potentialities. The inference should not be made, however, that this definite long time relationship makes any of these units an acceptable basis for population estimates. While per capita use is valuable in studying the consumption trend of particular goods and services, the units themselves have varying degrees of merit as a basis of population estimates because of fluctuating usage, and because of inherent characteristics from a statistical standpoint. Therefore, as will be shown later, first preference is given to units which are most

closely related to population changes and which have the least skewness such as family capacities, families and persons per family, and the other units are given second or third preference, or ruled out altogether. In other words, the aim is to select those units which have the least probable error in making population estimates and use the others if possible corroboratively.

CLASSES OF URBAN POPULATION

The infrequency of official governmental censuses compels annual estimates of local population growth to meet the needs of urban and suburban communities. These estimates are usually based upon such indices as water, gas and electric meters or services, telephones, registered voters, school and postal data, city directories, assessed valuation, and building data. While in some instances the estimates are carefully made, generally, the limitations and qualifications of the data are not known or realized. The results are often of questionable value because scientific approach and methodology are not used consistently. Population estimates and related data of a locality, from supposedly responsible sources, have been known to vary 25, 50, and even 100 per cent. Such conflicting data invariably cause confusion, have their reactions, and are a liability.

Happily some states take their own decennial censuses midway between the Federal census, thus, data are available every five years, which give more frequent official anchorage. However, governmental censuses are not as representative as is ordinarily believed by the user of such data. The national population census, for instance, is required by the Constitution and initially was designed primarily as a basis for the apportionment of taxes and governmental representatives. Therefore, the Federal Bureau of the Census enumerates persons at their "usual place of abode," or "the place which they would name in reply to the question 'Where do you live?'" or "the place which they regard as their home." The instructions to enumerators elaborate upon the meaning of these and other terms but the basis is still subject to broad interpretation.

The persons so enumerated may be termed "permanent population," but this is not necessarily the population which is demanding food, clothing, housing, public utility services, governmental facilities, or personal and financial services in a particular locality. There may be several groups of population. In any sizable urban area there are usually four classes of persons (1) permanent population, or Federal census population, usually those who claim a locality as their regular

place of abode, or home, or where they live (2) non-permanent population, those seeking retirement, work, education, health or recreation, who customarily live in a community for many months or even years at a time in furnished single or multiple dwellings, in hotels, boarding houses, or in summer or winter homes of their own (3) traveling transient population who live in hotels, auto courts or camps, trailers, construction camps, and the like, usually for a few days or several weeks (sometimes months) (4) daytime transient population, those who come from the surrounding suburbs or rural areas and remain a day or some part of a day for work, business or recreation. For want of better terminology these four urban classes may be briefly designated as (1) "permanent residents" (2) "nonpermanent residents" (3) "traveling transients" (4) "daytime transients."

In certain communities many persons living there almost continually will not declare it their regular residence or their usual place of abode, or will not change their legal situs to conform to their regular residence because of home ties, taxation obligations, political or financial reasons, wanderlust, etc. The actual population to be served from an economic standpoint and used as a basis for planning, therefore, may be much larger than that enumerated by the Bureau of the Census due to the regular or irregular movements of retired persons, tourists, workers, students, shoppers, military personnel, etc. From data gathered in many field surveys by the author, the total resident population in sizable communities at a given census date has exceeded the so-called census permanent population from 18 to 120 per cent, and there is considerable evidence that the Census enumeration is occasionally a gross understatement of even the permanent population.¹ On the other hand, nonpermanents excluded in one locality are included in some other locality as permanents by the census. This may concentrate upon particular localities and thus cause the census population to be far in excess of the actual average annual resident permanent population. This proves further than certain local economic planning should be based upon tributary resident population rather than census theoretically permanent population.

These conditions cited emphasize the need for a scientific estimate, even at the time of the Federal enumeration, as a check upon the accuracy and representativeness of the census itself. To some this may appear preposterous, but it certainly would be insurance against glaring errors.

¹ For instance, economic planning surveys based upon thorough field censuses conducted for a telephone company of communities involving a population of approximately 500,000 brought out a number of these discrepancies.

Population estimates and forecasts are one of the mainstays in most pieces of local planning work, and the federal census population data are extremely valuable, in fact indispensable, but these data must be used with discrimination. Many consider the federal census population count of their community as *the* population. However, it has been shown that there are four distinct classes of urban population, and the specific use determines the classes to be included. For example: A rapid transit or surface railway study in a metropolitan area must encompass all four classes. Indeed the existing and probable future daytime transients in this case comprise one of the most important groups. The number of daytime transients largely determines the downtown shopping, restaurant, and theater floor space, the downtown street, automobile parking and utility capacity, and the elevator facilities in stores and office buildings in the business center. When we study births, deaths and marriages, the daytime transients are obviously ruled out, while the prevailing number of traveling transients and nonpermanents, always in a large city, may have some bearing on certain phases of these vital statistics. An analysis of property taxation or public debt in relation to population would be confined largely to the census or permanent resident population, but a sales tax analysis would again include all four classes. The number and class of traveling transients would determine the supply of hotel and lodging house accommodations, while the number and class of nonpermanent residents would be a main demand factor in the provision of furnished single and multiple dwellings. For water, gas, electric production and sewage disposal all four classes must be considered in a given locality, but for the outside plant facilities (pipes, lines, substations, etc.) in the non-downtown areas the number and distribution of permanents and nonpermanents control. Local telephone exchange service is predicated largely upon the two classes of permanents and nonpermanents, but the supply of pay station and toll service is influenced by the number and activities of the traveling and daytime transients.

These examples indicate that our urban population is a heterogeneous mass of persons composed of several groups which must be differentiated, and that the federal census covers only the number and distribution of one group in a given urban area.² Private and local governmental agencies therefore have been compelled to study and determine the status and trend of the other three groups in specific undertakings.

² In this connection, I raise the question whether Edward L. Thorndike in his article "Variations Among Cities in Per Capita Income" has sufficiently taken into account the effect of the three classes of population herein defined besides the census permanent population (this JOURNAL, September, 1937, pp 471-479)

The purpose of this article is not to make a qualitative analysis, but to confine the remarks as much as possible to the quantitative aspect, that is, to throw some light on obtaining the right number of persons for specific local purposes, and these remarks are intended to be indicative and not conclusive. Thus, if we are forced to make intercensal and postcensal estimates of our urban population and its distribution within a local area, what are some of the rules and considerations that apply in this procedure?

1. Determine what class or classes of population are applicable to the planning problem in hand
2. Select a simple unit or units whose changes are most closely related to the specific population changes to be measured.
3. The area of the subject for study and the area of population should be coextensive.
4. The population indices should be available monthly or annually from reliable sources.
5. Avoid units or methods which are involved and excessively costly to apply.
6. When forecasting population changes in a local area, or its sub-areas, study the whole historical record of the growth with respect to the causes for change; the sources of increase as to the proportion of natural increase, immigration and annexation; the past and probable future trends in numbers and percentages tabulated by significant periods and measured by plotting according to arithmetic and geometric scale taking into account the probable future causes and sources of change.

The reason for unrepresentative estimates and consequent economic losses is that the above rules have been ignored or violated in whole or in part, while faulty forecasts are brought about for the same reasons except that unforeseen conditions arise such as the discovery of ore or oil, unusual governmental or institutional activities, or major changes in transportation routes which sometimes make population growth temporarily unpredictable.

CHECKS UPON CITY GROWTH

It is clear that the growth of inhabitants of any locality is more or less dependent upon the general trend of population growth in this country and in the civilized world at large. The status and trend of the birth rate, death rate, emigration and immigration all ultimately have a bearing upon the future growth of any locality. The long time growth of a city should be analyzed as to the proportions of inhabitants obtained from natural increase, from local and international net immigration and from annexation.³ Decentralization of such activities as manufacturing and retail trade is having an important bearing upon the growth of our large urban centers and their suburbs. On the other

* *Annals of the American Academy of Political and Social Science* (November, 1936), pp. 167-176, et al.

hand, our rural areas are passing through an epochal transformation. The small cross-roads-general-store type town is disappearing and in its stead is developing the larger chain store shopping and amusement center. Here centralization in the form of urbanization is going forward rapidly and no doubt has its effect upon the rural rate of natural increase.

VARIOUS UNIT BASES

According to the rules suggested a number of units or indices eliminate themselves. Monetary units such as bank clearings, value of building permits, assessed valuation or postal receipts, which fluctuate with business volume and prices, are definitely unsatisfactory. The number of registered voters which varies with the intensity of political campaigns, usually regardless of population status, is of questionable validity. Note the wide fluctuation often in the number of registered voters for local and national elections in the same year. Studies over a period of years have proven that the number of persons per voter is very erratic. Furthermore, it does not reflect changes in the size of family and it excludes foreigners. The long time trend is affected by registration requirements such as sex distinction, age limits, naturalization, etc.

The number of names in a city directory is often used as a basis of urban population estimates. It has many limitations, such as listings of suburban or outside residents in business in the respective city; it may violate the area requirements which is difficult to correct; occupied adults are listed while women at home and children are omitted, and it does not reflect changes in size of family unless the factor of persons per net name is adjusted. It is not always available annually, and the canvass of listings is spread over a considerable period, thus, there is uncertainty of fixing a definite date. The inclusiveness of names depends upon the efficiency of the field personnel and thoroughness of canvass; and a progressive improvement from the census, or base year, will result in too high an estimate. It is not an official source. During the twenties the author carried on historical studies of city directories of Los Angeles as a basis for population estimates, but found them of problematical value.

Water, gas and electric meters or services as indexes of population growth have varying degrees of reliability. Utility serving areas often do not conform to city or study area boundaries; several companies may serve a city; all meter districts, or parts of such districts, outside of the study area should be excluded both in the base year and in the year of estimate; the change in the proportion of master meters is a

likely source of error; the increasing proportion of business meters will distort the estimate, therefore, residence meters are preferable; duplicate breakdown electric meters should be eliminated; the federal census permanent persons per meter in the base year excludes the non-permanent persons served, and subsequent changes in the ratio of non-permanents served vitiates the comparability of estimates, particularly of presumably permanent persons, with those of the census year. Telephone station data present certain difficulties cited for meters, especially area differences. They are subject to such relatively wide variations in usage caused by cyclical business conditions, and disproportionate growth of extensions as to make them a difficult gauge of population growth. Estimates based upon primary residence stations with due regard to changes in saturation give a more reliable estimate of population growth than total stations.

In the last analysis, since practically every family capacity in an urban area has a water meter or service connection, the number of these meters or services is a fairly acceptable basis for population estimates, because they are not so subject to increased saturation and discriminate uses as electric meters or telephones. Gas meters, in a measure, in some areas of intensive use, have the same characteristics as water meters. Both, however, are subject more or less to the limitations cited above.⁴

Average daily attendance and enrollment in the elementary school grades, first to eighth, is a usable index of population changes, if properly qualified and applied. High schools, junior colleges, special adult schools, etc. have a variable enrollment not consistent with intercensal population growth. Changes in laws for compulsory attendance, efficiency of truancy law enforcement, declining birth rates,⁵ differentials in the proportion of permanents and nonpermanents (the latter usually with fewer children per family than permanents) in the

⁴ Cautions which particularly apply to water meters are as follows. The term water services or meters is occasionally used to include dead-end connections, that is, those ends of consumer service pipes still in the ground but not used. These may never be used due to removal or destruction of buildings, as, for instance, the replacement of many small residences by large stores, manufacturing establishments, public buildings, or by schools, parks, etc. The consumer service connections laid to the property lines of vacant lots in subdivisions where streets are hard-surfaced are frequently included as meters and services, but represent no family occupancies. Additional sources of error are the lack of distinction between active and inactive meters; the presence of flat rate, or unmetered services, in presumably completely metered areas, the fact that water meters are kept active to care for lawns, shrubs, and trees even when the premises are vacant; the individual family capacity vacancies are not disclosed in multiple family houses having master meters, and the increased proportion, after the base year, of meters or services representing public uses such as city departments, schools, parks, fire hydrants, sewer flushing, etc., will cause over-estimates of population. Likewise, doubling up of families, as during the last depression, is not recorded by water meter data.

⁵ Paul V. Lane of the California Taxpayers Association has prepared an estimate of birth rate correction factors for California.

base year and subsequent estimate years,⁶ ratio of private and parochial school pupils, fluctuations in child labor, changes in school district boundaries, and transfers between schools are all disturbing conditions in school data which must be critically appraised to derive acceptable intercensal population trends. Certain other bases for estimates have varying degrees of reliability.⁷

Estimates, either postcensal or intercensal, predicated upon previous decade increases employing straight line arithmetic projection are frequently in gross error as was exemplified by the Bureau of Census postcensal estimates for large cities between 1920 and 1930. The Pearl-Reed Logistic method, employing a biological theory, was found wanting when applied to the urban or metropolitan population of Los Angeles, principally because natural increases have been a minor proportion of the total growth, while immigration has been the dominant part.

FAMILY CAPACITY METHOD

This method was developed fourteen years ago by the author in making estimates and forecasting the population of Los Angeles City.⁸ The first study was published in October, 1923 in the Bulletins entitled "Los Angeles Business Statistics" which preceded the "Eberle and Riggelman Economic Service" published beginning September 1, 1924.⁹ The initial details of this method were as follows: The number of permanent families within the city was ascertained from the census of 1920. Family capacities occupied by nonpermanent families and those vacant, based upon private surveys, were added, together with the dwelling units under construction on January 1, 1920. This completed the ascertainment of total permanent and nonpermanent family capacities. According to the official building permits the succeeding monthly family capacities provided, minus demolitions, were added up to the

⁶ Erle F. Young omitted to take the nonpermanent population into account in his review of methods estimating population for dynamic communities, *American Journal of Sociology* 38, 577, Jan. 1933.

⁷ Postcensal population estimates based upon net gain of births, deaths, immigration and emigration, while applicable to national estimates, are difficult to apply to localities, due to the uncertainties of ascertaining net immigration. Combinations of monetary, physical or natural unit estimates are of doubtful value because extreme bias of one unit may jeopardize accuracy. An estimate of adults based upon city directory listings, supplemented by children derived from school enrollment, and indirect use of births, was found better than school data or directory estimate alone. (See *The Annals of the American Academy of Political and Social Science*, Nov. 1936, pp. 167-176) Studies by the author of combinations of units, or averages of the same unit for various cities, have generally been found unsatisfactory. Rather, population growth should be measured comparatively by single units for each city or study area in accordance with the characteristics of its population and the availability and adaptability of specific data.

⁸ John R. Riggelman collaborated in the development of this method.

⁹ The Service was later published as the "Eberle Economic Service" and discontinued September 1935.

desired date of estimate. The vacant family capacities and dwelling units under construction at the date of estimate were determined and deducted from the total cumulative family units. This resulted then in the total family capacities permanent and nonpermanent which were occupied. According to sample field survey estimates, the nonpermanent families were deducted to obtain the net total permanent families which in turn were multiplied by the persons per family as indicated by census enumerations and private investigation, and adjusted for trend. Finally, the populations of all annexations since the date of the census were added. The result was the total number of permanent persons in the city at the desired date, which could be compared with the number of permanent persons enumerated at the date of the 1920 census with and without annexation. To obtain the total permanent and nonpermanent population for economic purposes the nonpermanent family capacities were changed to persons and added to the above figure resulting in the total number of permanent and nonpermanent classes of persons in the city including annexations.¹⁰

By this method in 1923 and 1924 a forecast was developed and published for Los Angeles City for 1930 of 1,250,000 persons which compared very favorably with the census on April 1, 1930, of 1,238,048. The progressive quarterly estimates of permanent population begun by this service in 1924 ultimately cumulated to 1,304,130 on April 1, 1930,¹¹ which would have been lower if adjusted for nonpermanents in annexations, and loss of family capacities destroyed by fire and converted into business units by the terrific building boom during the twenties, but there was no official record of these losses. With these adjustments and reductions the cumulated estimate at April 1, 1930, would have been quite comparable with the census.

The family capacity method incorporates many desirable features. Family capacity changes are closely related to population changes; the unit is secured from reliable official sources; it is not biased by fluctuations in business volume or prices; the data are legally confined

¹⁰ Since the census of 1920 did not report private and institutional families separately, the family capacities based upon the 1920 census included these quasi families. Even adjusting the persons per family to a private family factor (basis 1900) and applying this factor to permanent family capacities occupied during the year of estimate resulted in a small error—due to the omission of permanents in hotels, clubs and other quasi family capacities constructed since the census year and not included with the official building department dwelling classification. Also an irregularity is caused by applying the persons per private family to the total permanent family capacities which included the census quasi families. To include all possible permanents and nonpermanents in the year of estimate the persons per family based upon both private and institutional families should be applied to the total permanent plus nonpermanent family capacities occupied including institutional family capacities.

¹¹ See *Eberle Economic Service*, Vol. VII, pp. 157-158, August 11, 1930; also September, November, 1923; January 1924; April 14, 1930.

to the city area, and the estimates of persons per family are based upon primary official sources available for decades. Quasi family capacities and doubling up of families in depressions are some of the sources of error but are of minor importance. Relative to the degree of accuracy the family capacity method has proven reasonable in cost.

CONCLUSIONS AND RECOMMENDATIONS

A high degree of accuracy can be obtained in making estimates and measuring changes of population, or related data, if there is definition, classification and qualification as indicated in the foregoing discussion. Only the kind or kinds of population should be used which fit the purpose. Monetary units as a basis of population estimates should be avoided. Unscientifically prepared population data may lead to the adoption of unsound policies resulting in waste of human effort, natural resources, and public and private funds. Physical and natural units are preferable because here they have greater stability and applicability.

Family capacities, families and persons per family should be given first preference. Family capacity source data should be refined to include quasi family capacities (hotels, lodging houses, etc.), and adjusted for losses caused by obsolescence, depreciation, fire, the elements, conversion, cancellation of permits, moving, etc., and those added by conversion, moving, alterations, etc. Generally, the probability of error appears to be less in estimates based upon family capacities and persons per family than in other estimates.

Utility meters and services should be given second preference, especially water and gas data. These should be refined to make them more adaptable for estimating urban population changes by including, as far as possible, only meters serving premises used for human habitat; by excluding inactive meters at the date of estimate; by sample checking vacancies in structures served by master meters and by other active meters, and by attention to persons in quasi family occupancies. Such refinements are not costly.

Estimates based upon elementary school data should be given third preference. These data should also be refined and adjusted as indicated previously to make them as representative of population growth as possible.

Finally, all estimates and forecasts should be checked and tested in the light of the absolute and relative growth by tabular and graphic analyses.

In reference to enumeration it would be very desirable and useful from the standpoint of local economic planning if the Bureau of the

Census in 1940 would include in the population schedule items to show the number of nonpermanent persons and traveling transients in at least the larger cities and metropolitan areas. The Bureau must practically cover the universe anyway to obtain the permanent population. This would provide a check for intercensal estimates of these classes of persons, and if repeated each decennial census would indicate trends not hitherto available. Besides, it would require the enumerators to be more discriminate and indirectly improve the accuracy of the count of permanent persons. Finally, the census officials must recognize the probability that, due to the increased mobility of our population, the application of the customary constitutional definition of permanent persons in taking the census may, for practical purposes, become progressively more untenable.

THE STANDARD DEVIATION OF SAMPLING FOR LIFE EXPECTANCY

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IT HAS long been customary to take as the standard deviation of sampling for a death rate p per capita the formula $\sigma = \sqrt{pq/n}$ where n is the population on which the rate is based. In comparing rates this standard deviation is used to guide the judgment as to whether the samples are large enough so that the difference in the rates is more than might be expected to be due to random differences between samples. More recently much emphasis has been laid on the expectation of life at birth as an over-all index of mortality in a population and life tables have been computed for relatively small populations, particularly for the purpose of comparing the expectations of life at birth, ℓ_0 , in different populations or of comparing the life table death rates ($1000/\ell_0$) per thousand or $1/\ell_0$ per capita. Such comparisons are generally made without reference to the corresponding standard deviations.

The expectation of life ℓ_x at age x is sometimes defined as the average duration of life beyond age x of a cohort l_x of persons starting together at age x . If ℓ_x were actually computed in accordance with this definition, the sampling error of ℓ_x would be the standard deviation of the frequency function d_y , $y \geq x$, of deaths at ages from x on divided by the square root of the number l_x of persons involved.¹ But ℓ_x is never thus computed and the standard deviation of any estimate of a quantity has to be figured from the manner of estimation.

The expectation ℓ_x at any age x is actually deduced by a mathematical calculation from the age specific death rates; by definition it is the average number of years lived after age x by a group of l_x persons alive at age x , i.e., $l_x \ell_x$ is the total number of years lived by the cohort l_x . Now, if in some particular age group y to $y+h$, subsequent to age x , the value of q_y , the chance of dying between those ages, should per chance be increased by δq_y , the number of deaths would be increased by $l_y \delta q_y$ and the years lived would be diminished in that age interval

¹ The standard error $\sigma(\ell_x)$ may perhaps be roughly estimated as the standard deviation $\sigma(d_y)$, $y \geq x$, of the d_y curve taken from the computed life table divided by the square root of the total number of deaths D above the age x which went into the calculation of the life table, but this estimate has been found somewhat unreliable; we should probably do better to use for D the life table death rate times the population.

by $\frac{1}{2}h l_y \delta q_y$ and in all ages above $y+h$ by $l_y \ell_{y+h} \delta q_y$. Thus the expectation of life ℓ_x would be changed by

$$\delta \ell_x = - l_y (\ell_{y+h} + \frac{1}{2}h) \delta q_y / l_x. \quad (1)$$

To a first order of approximation, regarding δq as infinitesimal, the total change in ℓ_x from variations δq in different age groups would be the sum of the individual changes, viz.,

$$\delta \ell_x = - \sum_{y \geq x} \left(\frac{l_y}{l_x} \right) (\ell_{y+h} + \frac{1}{2}h) \delta q_y \quad (2)$$

where the summation extends over all intervals h , not necessarily equal, from age x on to the end of the life table. As the variations δq are supposed to be those of random sampling they must be assumed to be uncorrelated and the square of the standard deviation of ℓ_x is therefore

$$\sigma^2(\ell_x) = \sum_{y \geq x} \left(\frac{l_y}{l_x} \right)^2 (\ell_{y+h} + \frac{1}{2}h)^2 \sigma^2(q_y) \quad (3)$$

In getting the formula it has been assumed that the deaths were spread uniformly over the interval x to $x+h$; for some intervals such as "under 1" or "under 5" this might not be so satisfactory as to assume that the average period lived during the interval was ch instead of $\frac{1}{2}h$. Moreover it often happens that deaths or populations at the older ages are available only in a wide group such as "75 and up"; in this case it may perhaps be assumed² that

$$\ell_{75} = \frac{1}{m_{75}}, \quad \delta \ell_{75} = - \frac{l_{75}}{l_x} \frac{\delta m_{75}}{m_{75}^2}, \quad \sigma^2 m_{75} = \frac{m_{75}(1 - m_{75})}{n_{75}} \quad (4)$$

where m_{75} is the rate of mortality per capita for ages 75 and up and n_{75} is the population 75 years of age and older. With respect to σ_q^2 except in the last interval we have³

$$q = m / \left(\frac{1}{2}m + \frac{1}{h} \right), \quad \frac{1}{q} = \frac{1}{2} + \frac{1}{hm} \quad \text{or} \quad 1 - c + \frac{1}{hm}, \quad (5)$$

² The final term in (2) would become meaningless, since for the last interval q_y is 1, ℓ_{y+h} is 0 and $\frac{1}{2}h$ will not do for the average years lived. The assumption in (4) is that the distribution in the last interval is stationary.

³ If q were estimated directly as the probability which it is, its standard deviation would be the square root of $q(1-q)/n$ but as q is estimated from m it is necessary to follow its method of estimation.

provided we use ch in place of $\frac{1}{2}h$ for the average life of those who die in the interval. Then

$$\frac{\delta q}{n^2} = \frac{1}{h} \frac{\delta m}{m^2} \quad \text{and} \quad \sigma^2(q_y) = h^2 \left(\frac{q_y}{hm_y} \right)^4 \frac{m_y(1 - m_y)}{n_y}. \quad (6)$$

In the particular group "under 1", q_0 is generally taken as the infant mortality per capita and $\sigma^2(q_0) = q_0(1 - q_0)/B$ where B is the number of births on which the infant mortality q_0 is based. In case we compute rates from average deaths for k years, the populations n_y or B are to be multiplied by k .

Thus $\sigma^2(\ell_x)$ may be computed from the data for the life table and from the entries in it. An example of the computation of $\sigma^2(\ell_0)$ follows:⁴

ONONDAGA COUNTY, N Y, 1929-1931, AVERAGE DEATHS

Age	Deaths	Population	m_x^{x+h}	l_x	q_x	ℓ_x
<5	355	23,800	.01492	1000	.0701	61.7
5-14	76	51,900	.001464	930	.0145	61.3
15-24	104	47,400	.002194	916	.0217	52.1
25-44	395	91,500	.004317	896	.0328	43.2
45-64	1002	58,400	.01716	822	.2930	26.2
65+	1468	18,900	.07773	581	—	12.9

We take $c = .14$ for the first group. Then

Age	l_x/l_0	$\ell_{x+h} + ch$	Prod	$10^{-4}(\text{Prod.})^2$	$10^4\sigma^2(q)$	Prod.
<5	1 000	62 0	62 0	3844	.0401	0154
5-14	930	57 1	53 1	2822	.0091	0026
15-24	916	48 2	44 1	1949	.0148	0029
25-44	896	36 2	32 4	.1051	.0529	0056
45-64	822	22 9	18 8	.0353	.205	.0072
65+	581	—	(96 2)	(.9259)	(.0126)	(.0117)

⁴ Of course, a six interval life table is decidedly sketchy; but my colleague Dr. C. R. Doering, who has in preparation a considerable discussion of life tables from which this particular illustration is taken, finds that for many purposes such a method of calculation is adequate. See C. R. Doering and A. L. Forbes, *Proceedings Natl. Acad. Sci.*, 24 (1938), 400-405. On the basis of a thirteen interval life table for this same county, $\ell_0 = 61.3$ instead of 61.7 and $\sigma(\ell_0)$ is .200 instead of .213 as found here. It seems unnecessary for the present illustration to increase the detail by using a larger number of intervals than six.

where the terms in parenthesis in the last line are the special values needed for the last term.⁵

$$-\delta\ell_0 = 62.0\delta q_0 + 53.1\delta q_5 + 44.1\delta q_{15} + 32.4\delta q_{25} + 18.8\delta q_{45} + 96.2\delta m_{65} \quad (7)$$

$$\sigma^2(\ell_0) = .0154 + .0026 + .0029 + .0056 + .0072 + .0117 = .0454$$

Hence $\sigma(\ell_0) = .213$, $\ell_0 = 61.7 \pm .213 = 61.7(1 \pm .00345)$

and $1000/\ell_0 = 16.21(1 \pm .00345) = 16.21 \pm .056$.

Although it is a little to one side of the matter of $\sigma^2(\ell_x)$ one may remark that (2), with the proper last term taken from (4) and with the term $\frac{1}{2}h$ replaced by ch for the first interval, gives a value of $\delta(\ell_0)$ for any changes in the age specific death rates. The value like that for $\sigma^2(\ell_0)$ based upon it must be considered approximate because through the work it has been assumed that δq is infinitesimal and that infinitesimal effects are additive since infinitesimals of higher order are neglected. A test of (2) for the above table may be made from (7) if we assume that the values of the mortality rates m are all increased or decreased by 10 per cent. From (7) by computing the δq 's one finds that $\delta\ell_0$ is -2.04 or 2.06 respectively on the two assumptions of increase and decrease. A direct calculation of the life tables from the changed rates gives the values -1.95 and 2.23 for $\delta\ell_0$ to which those obtained from (7) may seem sufficiently near.⁶

⁵ Namely, $(l_{65}/l_0 m_{65}^2)$, the square of this $\times 10^{-4}$, $10^4 \sigma^2(m_{65})$, and the product of the last two.

⁶ The analysis of the standard error of a life table applies of course only to the method of direct calculation from the raw data as developed by Dr Doering and Miss Forbes. Life tables are usually computed only after smoothing the data. How much such processes do toward affecting the values of ℓ_x is an interesting question. For small districts the effect would probably be less than the sampling error, for large districts it might be greater. In any case that method of calculation would have to have its own sampling error properly determined. Finally it may be remarked that only pure chance variation has been admitted in the age specific death rates, whereas it is well known that the actual variations in them which remain unexplained and cannot be corrected for are larger than those due to chance and are not uncorrelated as between the different age groups. The fluctuations which occur in ℓ_x from no as yet assignable causes are probably what the practical statistician might well call chance variations. To study them in a search for their causes it is desirable to have an easy method of calculating life tables and some fairly satisfactory estimate of the sampling error of ℓ_x .

NOTES

MEASURES OF CHANGES IN FERTILITY IN GERMANY¹

The rapid decline of birth rates below the levels necessary for permanent population replacement has focused attention on the possibilities of direct governmental action in stimulating a rise, or at least avoiding further decline. The changes in the German birth rate are of especial interest. In 1933, it was 14.7, and the net reproduction rate was .70; in 1936 the birth rate had increased to 19.0 and the net reproduction rate to .89, which is significantly above the 1933 level.² The total number of live births was 971,000 in 1933; 1,198,000 in 1934; 1,264,000 in 1935; and 1,279,000 in 1936. This increase in the four-year period amounted to 32 per cent.

Naturally there was considerable interest, both within and without Germany, in evaluating the effectiveness of the various governmental programs intended to stimulate a rise in the birth rate. The Statistisches Reichsamt has greatly expanded the scope of its vital statistics in order to estimate quantitatively the extent to which the increased number of births is due to the increase in marriages and hence is only transitory. Dr. Friedrich Burgdörfer, director of the population section of this Bureau, concluded from an analysis of these data that the number of births in Germany during 1934-36 was greater by 900,000 than would have been expected had the number of marriages remained at the 1932 level and the fertility rate continued at the 1933 level; approximately 300,000 or one-third of this increase can be attributed to an increase in the number of marriages; and the remaining 600,000 or two-thirds of the total, is to be attributed to a true increase in marital fertility.

The basic materials for Burgdörfer's studies were secured through a combination of census data, birth and death registrations, and records of marriage and divorce. The Census of 1933 was the first German one to secure detailed information on marital fertility.³ In the tabulations of that census, married women were classified accord-

¹ The material in this note is based on two articles by Dr. Friedrich Burgdörfer: "Familienstatistik und Fruchtbarkeitsmessung Neue Aufgaben und neue Wege der deutschen Bevölkerungsstatistik" *Revue de l'Institut International de Statistique* 5(3): 212-226 Oct 1937, and "Die neue deutsche Bevölkerungsentwicklung im gesamteuropäischen Rahmen mit besonderer Berücksichtigung der zahlenmassig erfassbaren Auswirkungen bevölkerungspolitischer Massnahmen" *Archiv für Bevölkerungswissenschaft (Volkskunde) und Bevölkerungspolitik*, 7(5/6): 321-347 Nov and Dec, 1937

For a description of the fertility data of the 1933 Census see Henel, Eberhard, "Die familienstatistischen Ermittlungen bei der letzten Volkszählung." *Archiv für Bevölkerungswissenschaft (Volkskunde) und Bevölkerungspolitik*, 7(5/6) 321-347. Nov., and Dec., 1937.

² *Population Index*, 4(2): 128. April, 1938

³ *Statistik des Deutschen Reichs*. Vol. 452, No. 1.

ing to year of marriage by single years 1913 to 1933, and for the years 1908-1912 and 1907 or before.

Detailed tables were presented giving married women by year of marriage, year of birth, and number of children born, for various regions and minor areas, and by religious affiliation, social status, amount of land, ownership of land for agricultural and non-agricultural populations, and gainful employment of married women.

For the purpose of Dr. Burgdörfer's computations, it was possible to secure from the 1933 Census basic information concerning the distribution of married women by age and duration of marriage. However, the current tabulation of the fertility of married women by age and duration of marriage required an expansion of the information collected on births, deaths, marriages and divorces. Therefore, the number of legitimate births is now regularly tabulated by order of birth, age of mother and duration of marriage. Furthermore, the number of women married in each year is tabulated by year of birth. For marriages dissolved by death or divorce, information is secured to show year of marriage, year of birth of the woman and number of children born to that marriage.⁴ Beginning with 1933, vital statistics were tabulated by usual residence.

On the basis of these data the number of married women by age and duration of marriage can be computed annually. The number of legitimate births, classified by order of birth during the year is related to this base, and the resulting rates permit detailed annual comparisons.

Table I illustrates the type of data available and shows some typical results. With few exceptions the values in 1934 and 1935 exceeded the values in 1933 and those for 1935 exceeded those for 1934. The increases extended to the several birth orders and to marriages which had been in existence long before 1933, as well as those contracted since that time. The more detailed table from which items in Table I were excerpted similarly shows increases for nearly every birth order and grouping by duration of marriage. The greatest increase occurred in those marriages which had existed between 3-13 years. Among them the increases ranged from 33-49 per cent. The increase among marriages which had lasted less than 4 years was less pronounced. This is attributed to the fact that fertility is comparatively high in the first years of married life, even during a time when fertility rates in general are at a very low level. The major contribution of the marriages since 1933 to the total number of births is therefore due to the increase in the number of marriages.

⁴ For the tabulations for 1933 and 1934 see Vol. 495, *Statistik des Deutschen Reichs*, Part 2.

TABLE I
MARITAL FERTILITY IN GERMANY, 1933-1935, FOR SELECTED YEARS

Year	Average duration of marriage in years	Year of marriage	Number of married women under 45 years of age on Jan 1 of specified year	Number of legitimate births during specified year per 1,000 married women*						
				Total	Order of birth					
					1	2	3	4	5	6 and over
1933	1	1932	487	318.87	271.30	43.41	3.69	0.42	0.03	0.02
1934	1	1933	616	344.57	292.78	46.54	4.55	0.55	0.10	0.05
1935	1	1934	715	329.87	282.76	42.51	3.90	0.58	0.08	0.04
1933	7	1926	418	91.81	7.80	23.61	24.35	18.56	10.94	6.55
1934	7	1927	469	117.76	11.94	35.87	31.48	20.60	11.13	6.74
1935	7	1928	515	124.54	13.79	40.51	33.16	20.26	10.57	6.25
1933	13	1920	628	40.58	0.87	3.28	6.06	6.90	6.48	16.99
1934	13	1921	509	49.69	1.20	5.00	8.91	9.00	7.71	17.87
1935	13	1922	487	53.94	1.66	7.20	10.90	9.77	7.85	16.56

* Includes illegitimate children subsequently legitimized through marriage

Burgdorfer estimates the number of births expected if the number of marriages and the fertility rates had remained constant until 1936, in order to secure a quantitative estimate of the births which can be attributed to the increased number of marriages. The number of marriages in 1932 was taken as the base, and it was assumed that the same number of marriages occurred in each of the succeeding years. This number of newly married women was added to the totals found by the 1933 Census, and deductions made for marriages dissolved through death or divorce. The fertility rates reported during 1933 were applied each year to the computed number of married women classified by age and duration of marriage. This "expected" number of births is thus based on the assumptions: (1) that the number of marriages in each year remained at the same low level as in 1932, and (2) that the specific fertility rates continued at the low level of 1933. By applying these fertility ratios to the increased number of marriages contracted during 1933 and each of the subsequent years, it was possible to compute the number of births "expected" from the increased number of marriages, assuming that fertility rates remained at the 1933 level. The difference between the sum of these "expected" values and the actual number of births which occurred is attributed to a true increase in fertility, i.e., due to factors other than the increase in the number of marriages.

The figures for 1933-1936 are given in Table II, where column 1 shows for each year the "expected" number of births to women who

were married before January 1, 1933, plus those married since as computed according to the assumptions stated above. Columns 2-5 show the number of children "expected" as a result of the marriages contracted in 1933-1936 in excess of the number contracted in 1932. For example, the number of marriages in 1932 was 517,000; in 1933 it was 639,000 and the difference is 122,000. It is the latter figure which is used in computing the values in column 2. Column 7 gives the actual number of legitimate births occurring in each year. Column 6 is the difference between column 7 and the sums of columns 1-5. It is the increase in the number of births which is credited to a true rise in fertility.

TABLE II

THE INCREASE IN BIRTHS IN GERMANY* ALLOCATED TO INCREASED FERTILITY AND THE INCREASE IN THE NUMBER OF MARRIAGES, 1933-1936

Year	Base figure	Legitimate births†						Illegitimate births	Grand total
		The increase in number of births due to—					Total number of births		
		the increased number of marriages in				increased fertility			
		1933	1934	1935	1936				
		1	2	3	4				
1933	861,500	17,400	—	—	—	—	878,900	106,200	985,100
1934	858,700	37,800	32,100	—	—	181,500	1,110,100	104,800	1,214,900
1935	854,000	25,200	69,000	19,000	—	211,000	1,178,200	101,200	1,279,400
1936‡	851,500	19,700	46,000	40,600	13,400	220,000	1,191,200	101,200	1,292,400

* Excluding the Saar

† Including stillbirths

‡ Preliminary.

A complete quantitative evaluation of the various factors involved in this increase in fertility has not been attempted. Burgdörfer finds that during 1933-1935 couples who were granted marriage loans had a fertility rate 47 per cent greater than that among couples who had not been awarded such loans. He points out, however, that this differential may not be maintained permanently and that there may be selective factors, such as age and social class, which require further analysis before the full significance of the differences can be determined. As further data become available it may become possible to isolate some of the other factors which are involved in the changes in German fertility rates.

CONRAD AND IRENE B. TAEUBER

Washington, D. C.

A MECHANICAL INTENSITY SHADING MAP

The preparation of statistical maps of the United States illustrating comparative conditions of density by states, such as population per square mile, per capita automobile registration, percentage distributions of various economic and sociological phenomena, etc., by means of varying intensity shadings consumes eight hours and more, depending on the skill of the draftsman and on the type of shading used.

In order to reduce the time required for the preparation of maps of this type, the writer recently proposed and drew up specifications for a *mechanical* intensity shading map which is based on the very simple principle of the jig saw puzzle.

The device is constructed of aluminum and consists of a "base" and a cover. There are 6 sets of different shadings or "state pieces" for each of the 48 states, and the District of Columbia. To the aluminum "base" a skeleton grid of the map, consisting of the compartments for receiving the "state pieces," is fastened. The "state pieces" are interchangeable and fit snugly into the 48 "state compartments," allowing one to make up any desired combination.

It was found convenient and efficient to file the "state pieces" in a flat box provided with 48 individual sections resembling roughly the map of the United States. The time required to place the various "state pieces" into the "state compartments" does not exceed 15 minutes. The title and legend are prepared on strips of paper and are held in place with a light coat of rubber cement on the surface of the map. The frame with the glass plate is placed over the assembled map which is then ready to be photostated or photographed. The total time for completion of a map required approximately one hour.

The results obtained have been most satisfactory and the maps produced have a uniform appearance and cannot be distinguished from a regular drafting job. The principle of the device can obviously be extended to state maps by counties where the number of counties is not too large. The device was constructed by the Works Progress Administration.

R. VON HUHN

Works Progress Administration

THE NEW SYSTEM OF POPULATION ACCOUNTING IN THE NETHERLANDS

In the *Journal of the American Statistical Association* of December 1936, vol. 31, pp. 719-722, I stated that the new family-individual-card-index system has been tried successfully since 1930 in a number of communes of divergent types. After this number of communes had gradually risen to about 400 communes, embracing $\frac{1}{3}$ of the entire population, it was decided in 1938 by the Netherlands Government, on the suggestion of the Central

Statistical Bureau, to introduce this system in all communes before the census of population of 1940.

As a basis for the census, the family-individual-card-index system causes such a saving in the sum which the census would cost if the system followed in 1930 were applied that the cost of the introduction of the new system can be wholly defrayed by it.

Once the card for an individual is filled in with authentic data, it is never copied out again but in its original form, supplemented with a number of details noted in the course of the life of the inhabitant and transferred from one commune to another, it follows him from the cradle to the grave. On his decease, the cause of death is noted on the card which then, with all its data of demographic interest, can be used for statistical investigations. Besides the annotations which are exclusively necessary for administrative purposes, scientific data will be recorded on a supplementary card, concerning, for example, education received, examinations passed, special talent for art, science, politics, technical science, etc.; physical disabilities, idiocy, lunacy, alcoholic excess, hereditary diseases, feeding during the first year of life, etc.

The system opens up wide perspectives for simplification of municipal administration and at the same time for social research. On behalf of science, a Demographic and Genealogical Archive is being gradually created of great importance.

H. W. METHORST

Director-General of Statistics
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DR. Warburton's REVIEW OF *National Income and Capital Formation*—A COMMENT

Dr. Warburton's review¹ brings to the attention of readers the extent to which discussion and measurement of a single concept of national income involve a definite stand on many controversial issues in economic theory and social philosophy. It also illustrates the temptation to take a categorical position on these issues and damn with fine dogmatic zeal those who recalcitrantly view them from a somewhat different angle.

It is neither possible nor useful to consume the space of this JOURNAL in a prolonged discussion of the theoretical, factual, and terminological questions raised in the review. To provide facilities for such a discussion, both oral and in print, is one of the aims of the Conference on Research in National Income and Wealth. But I should like to state here as briefly as possible my answers to Dr. Warburton's critical observations.

1. The reviewer expresses regret that "national product" and "national income" are used to designate a sum of values, whereas "national product" would be "an especially descriptive and apt term" to designate the "congeries of specific commodities and services resulting from economic activity"

¹ See this JOURNAL, September 1938, pp 630-7.

(p. 631). But the term "national product" conveys the idea of a comprehensive measure of the results of the nation's economic activity; and such a comprehensive total is not and cannot be identical with any heap of specific commodities and services. If *net* national product is meant, then in addition to finished consumers' goods, one must include changes in inventories, in stocks of durable equipment, and in claims against foreign countries—items that cannot be resolved into a congeries of specific goods. If some of the various possible concepts of *gross* national product are meant, a more specific designation is needed; and most of the corresponding totals cannot be confined to a congeries of complete commodities and services. The total that Dr. Warburton seems to have in mind is perhaps best described by the term "total output of finished consumers' goods" or "total output of finished consumers' goods and durable productive equipment."

2. Dr. Warburton must well know that the national income totals as measured in the studies of the National Bureau of Economic Research, as well as those of the Department of Commerce, the National Industrial Conference Board, and all agencies that publish continuous estimates for this country, are derived by aggregating income payments to individuals and net savings of enterprises. The ambiguity in our statement of the method, alleged in the last paragraph on p. 631 of the review is thus a forced misconstruction of a single sentence.

3. The reviewer thinks that data regarding the value of services not embodied in new commodities are sufficiently plentiful and reliable to permit the preparation of continuous estimates of national income by the "final products" method and, indeed, designates as "sheer nonsense" my statement to the contrary. This is an evaluation of the existing supply of data in terms of the needs of a national income estimate; and every investigator in the field is entitled to his judgment. Strangely, however, the agencies mentioned under point 2 insist on the method of aggregating income payments and net savings. My personal opinion, based on experience with both methods, is that the aggregation of the value of final products yields the less reliable results, even when confined to commodities; and it is largely for this reason that the comparison of measures resulting from the capital formation study with those from the national income study had to be carried through in terms of three-year averages. As to services not embodied in new commodities, the data are far less adequate than for commodities, even for any single year.

4. The national income total as measured is confined largely to the product of activities whose results appear on the market. But not all activities whose results appear on the market can be considered productive of utilities or economic goods. This exclusion of marketable non-goods was sufficiently stressed in the report to prevent misunderstanding. As to products retained by farmers and net services of houses owned, the connection with the market referred to in the quotation on p. 632 of Dr. Warburton's review appeared to be sufficiently close to warrant inclusion. Aside from the question of

terminology, Dr. Warburton finds this procedure deficient in two principal aspects: first, the treatment of income derived from alcoholic beverages during Prohibition, and second, the treatment of income represented by services rendered by government.

5. Since as stated in *National Income and Capital Formation* (p. 6), it was impossible to exclude the activities of producing materials part of which was used for illegal purposes, the "inconsistency" in the estimates introduced by the repeal of Prohibition, although undoubtedly present, is perhaps not as great as Dr. Warburton suggests. But this "inconsistency" results from changes in the overtly expressed social judgment as to what is and is not productive. It could be avoided only by adopting strictly articulated criteria of productivity, to be determined by the estimator. This would be an exceedingly interesting experiment and has been urged by me in a discussion of Dr. Copeland's report in the *Income Conference Studies*, Vol. I (pp. 36-7). But the practical difficulties of carrying through this experiment can easily be imagined.

6. The treatment of income originating in government activity has been subject to extensive discussion in the first volume of the Conference studies, already referred to; and in the second volume, to appear by the end of this year. Readers interested in the problem should consult these publications for statements of conflicting positions. The viewpoint which we followed is that the principle governing the estimate of the net value of government activities should be the same as that applied to the activities performed under the aegis of the business system—namely, that the value of any good is measured by the price which it fetches on the market or the money paid for it. Hence, the evaluation of government activities is in terms of payments made for them, not in terms of their costs. A corollary and essential point in our treatment is that, for the bulk of government activities we do not consider it feasible to distinguish between services to individuals and services to the business system (and hence measure the value of free services rendered by governments to the body of ultimate consumers as a whole).

7. In analysing more specifically Dr. Warburton's critical treatment of our measurement of income originating in government activity, we begin with the case of a cosmetics industry before and after the tax. This case proves little, because it takes for granted, for the special case of teachers' services, the assumption which, as just stated, we hold to be invalid for most government services: that it is feasible to segregate the services of governments to ultimate consumers from those to business. It is this assumption that permits Dr. Warburton to assign the price of 0 to services of teachers, and derive in the fourth column of his illustrative table an index descriptive of retail prices for the total volume of finished products (i.e., cosmetics and teachers' services). Our position is that for most government activities the distinction between services to consumers and to business enterprises is inherently arbitrary; that even in the limited cases where the

activities appear on the surface to be for the exclusive benefit of either consumers or business (as, e.g., in education provided by the state), further scrutiny reveals a mixture of services to two masters; and that for the specifically governmental activities (defense, regulation, communication, public construction, etc.) the mixture of services to the business system and to ultimate consumers can be resolved only with the help of assumptions so arbitrary as to make the results almost worthless. It is not claimed that the position here stated and adopted by us is free from arbitrariness and compromise; but it involves much less of these elements than the approach that requires the segregation of government services to consumers from those to producers. At any rate, the construction of conundrums based on a selected group of government activities that, on the surface, appear to be services to consumers only, hardly provides a serious argument against our position.

8. Hence Dr. Warburton's illustrative example, presented by him as a demonstration of our position and of its absurdity, is inconsistent with the general viewpoint followed in our measurement of the net value of government services. From that viewpoint, it is not practicable to separate from government services as a whole final products flowing to ultimate consumers; and then to include their price in the index of retail prices. Indeed, the example represents a combination of Dr. Warburton's thesis that it is feasible to segregate services of government to ultimate consumers from those to business, with our position that government services should be evaluated at the prices paid for them, in the form of taxes by individuals and business enterprises.

9. Dr. Warburton is surprised at the results of treating income originating in government activity at prices paid for them, not at their cost,—with special application to the estimates for 1919, 1920, 1930 and 1932. The effect of such treatment is naturally to reduce the value of government activity whenever borrowed funds are used for purposes that lead to no increase in the government's tangible assets, as was the case in 1919 but not in 1920, in 1932 but not in 1930. (Some part of the difference in the former two years is due to crudities in adjusting fiscal to calendar years.) But why should we not take account of the fact that governments can consume a great deal more than what the citizens are willing to pay for government services, and consume it in uses that do not add to government assets? The only objection that might be raised against such treatment is that the government's wasteful activity should be charged not to government proper, but to the nation as a whole. But such an objection would be a qualification upon the propriety of segregating government as a branch of the economic system, similar to other branches. It refers to the *interpretation* of the estimates, not to the basis of evaluation. So long as we add income originating in government to income originating in other parts of the system, the basis of its evaluation should be consistent with the evaluation of the other parts. Dr. Warburton's argument as to borrowing against future tax collecting capacity appears to

me irrelevant, since he does not propose to apply this argument to any dissipation of borrowed funds by business enterprises in the expectation of profiting from the paying capacity of future would-be customers.

10. The Bureau of Labor Statistics index of the cost of living was applied, for "deflating" purposes, to consumers' outlay, the latter exclusive of expenditures on the acquisition of passenger cars. Consumers' outlay includes, by implication, direct payments by consumers to government. Prices of government services to consumers are not included in the cost of living index; nor, in accordance with our viewpoint, is it feasible to compute them. To the extent of this failure of coverage, the application of the cost of living index to consumers' outlay is not justified. But it is similarly not justified in application to any share of consumers' outlay spent on products whose prices have not been included or weighted properly in the cost of living index. It is for this reason that we considered the adjustment attained by the application of that index a crude approximation, and made an explicit statement to that effect in the report (p.10). But we thought such a crude adjustment preferable to leaving the totals in current prices, fully subject to the effects of changing price levels.

11. Dr. Warburton's preference for the term "undistributed income" or "undistributed earnings," as compared with the term "net savings" may be understood. But the former pair of terms has defects not inherent in the latter. Income and earnings must be understood as net, and there is considerable ambiguity in the terms "net earning" and "net income" (before or after tax? inclusive or exclusive of depreciation charges? etc.). On the other hand, it must be noted that the term "net savings" was introduced by us in 1934, before the fury of the Keynesian controversy served to obfuscate its meaning. It did not appear wise to change the term, since its exact meaning was clearly described and adhered to.

In closing, I should like to express a feeling of satisfaction at seeing the issues in national income theory, terminology, and measurement brought in Dr. Warburton's review to the attention of a wider group of students. But this feeling is greatly damped by the categorical character of the reviewer's statements and his inability to see the issues in their ramifications. Surely Dr. Warburton is aware of the controversial character of the issues; of the validity of various viewpoints, especially with reference to the various purposes that may be served by national income measures. It is because of this variety of valid viewpoints that *National Income and Capital Formation* presents separate measures of different parts and of different variants of the national total. The attempt has been made to allow students with different approaches or diverse purposes in mind, Dr. Warburton among them, to construct the particular total or allocation they may desire. The reviewer's inclination to manifest great surprise at statements expressing viewpoints different from his own and at statistical results that seem strange to him, appears to stem from the attitude that in national income analysis and measurement one's theoretical viewpoint and expectations concerning the

behavior of statistical results should not be disturbed by a different approach or by too "logical" a pursuit of its assumptions. This attitude I can neither share nor approve.

SIMON KUZNETS

National Bureau of Economic Research

A REJOINDER

The National Bureau of Economic Research commands a high respect among social scientists. Economists and other persons interested in national income measurements have looked to the Bureau's extensive investigations for the most authoritative estimates in this field. Those estimates will be used for many different purposes by many different persons. Under these circumstances it seemed to be the duty of a reviewer to call attention to the fact that the published results of the Bureau's investigations will inadequately serve some of the purposes for which the estimates are desired and have been obtained in part by methods which have been seriously questioned by other students of national income.

Dr. Kuznets is to be commended for attempting to present his estimates so as to allow students with different approaches or diverse purposes in mind to construct a particular total or allocation they may desire. This has not been done, however, in the case of the two items on which I expressed doubt about the year-to-year comparability of his results. In regard to alcoholic beverages Dr. Kuznets has not published his estimates of their cost to consumers nor his estimates of the income derived from their production and sale for the years in which he includes this industry in his totals. Students who believe that more comparable year-to-year figures are obtained by excluding or by including this industry for all years than by including it only during the years when it was legal are not able to construct the totals they desire.

The problem of evaluating governmental services has received careful consideration by participants in the Conference on Research in National Income and Wealth.¹ The participants in this discussion have almost unanimously supported the cost basis. They have recognized that this method involves the arbitrary allocation of certain governmental services to consumers and to business enterprises but have nevertheless considered the cost basis of evaluation to be superior to or equally valid with the direct tax basis. In *National Income and Capital Formation* no mention is made of the possibility that use of the cost basis might appreciably affect the national income totals. In this case also it is not possible for other students to con-

¹ Specific reference is made here to papers by Morris A. Copeland, Gerhard Colm, and the writer, published in *Studies in Wealth and Income*, Volume One, and by Lauchlin Currie, Gardiner C. Means, Robert Nathan, Richard W. Nelson, and Donald Jackson to be published in Volume Two, and to comments on these papers. Some of these papers have been presented to the Conference on Research since *National Income and Capital Formation* was written, but Dr. Kuznets must have been aware, at the time when that volume was under preparation, of the major issues discussed in them.

struct the totals they desire by substituting their own estimates of the cost of governmental services for Dr. Kuznets' estimates of the payment for them.² Dr. Kuznets has not published his estimates of taxes collected directly from consumers.

Dr. Kuznets avoids an estimation of the cost of governmental services to consumers by assuming that the "price" of such services (that is, amount of direct taxes collected relative to the volume of the services) varies from year to year in a manner similar to the cost of living index. This same assumption, he points out, is made with respect to any consumers' outlay on products whose prices have not been included or weighted properly in the cost of living index. Whether a cost of living index may appropriately be used as a "deflator" is a problem of judgment as to the reasonableness of this assumption. In the case of governmental services, this assumption seems to me clearly untenable. The amounts involved are too large for dismissal of the error as negligible.

Dr. Kuznets' comments on my remarks relating to government borrowings indicate that I did not make clear the nature of the question I raised. For this reason, I would like to introduce a new hypothetical illustration which bears a close analogy to certain actual changes in tax and borrowing policy during the period covered by Dr. Kuznets' estimates. Suppose that in one year the government furnishes to consumers services which cost four billion dollars and meets this cost by collection of that amount of taxes directly from consumers. The next year the government furnishes the same services at the same cost, but collects only half the amount in taxes. The other half of the cost is met by borrowing from its citizens instead of taxing them. Non-governmental production, prices and income payments are unchanged. Yet the actual income received by individuals in connection with government activity, whether thought of as the salaries and wages they drew from the government payroll or as the services they received from the government, is unchanged. The total output of goods and services is unchanged. Further, if balance sheet changes are inspected, the reduction in the net assets of the government (its increase in indebtedness) is offset by an increase in the net assets of individuals. Yet, Dr. Kuznets' estimate of income originating in government—both in current prices and in "constant" prices—would be only one-half of that for the preceding year, and his estimate of the national income would be two billion dollars below that for the preceding year.

Also, I must have failed to make clear the real character of my objections (1) to Dr. Kuznets' use of the terms "net national product" and "national

² Dr. Kuznets' estimates of total salaries and wages drawn from government—which provide an approximate measure of the cost of all government services to consumers and to business—cannot be used for this purpose. When the problem under discussion is approached by the method of aggregating income payments, the "missing" element in Dr. Kuznets' estimate is the value of governmental services drawn in kind from government: that is, the value of governmental services to consumers (including capital formation in the form of streets, public buildings, etc.) in excess of taxes paid directly by individuals.

income" as synonyms, and (2) to his statement regarding basic methodology in national income measurements. I agree with him in using "national product" as a comprehensive term covering the results of the nation's economic activity, including changes in inventories, stocks of durable equipment and claims against foreign countries. I do not, however, approve the use of the term "national product," whether gross or net, as a sum of values. The "national product" includes the potatoes, the shoes, the machinery, and the other things we have produced during the year. This medley of commodities and services (including changes in ability to claim such products from abroad) is a reality. "National income," or the summation of their monetary value, is an abstraction. We should be at least as generous in providing concise terminology for the realities as for the abstractions.

In *National Income and Capital Formation* Dr. Kuznets explicitly states: "The available data render it *necessary* (italics mine) to estimate national income by . . . the aggregate of all incomes paid to individuals plus net savings of all enterprises." (p. 5.) He now meets my criticism of this sweeping assertion by stating his opinion that an estimate of national income obtained by aggregating the value of final products would be less reliable than an estimate obtained by aggregating income payments and net savings of enterprises. I did not express an opinion regarding the relative reliability of the totals obtained by the two methods. What I said is that the missing elements in the estimate by the method of aggregating final products, namely, the value of services not embodied in new commodities, can be estimated as reliably as some of the elements which Dr. Kuznets has necessarily used in aggregating income payments and net savings. I also expressed my belief that both methods should be used, being kept as independent as possible, and the results compared. This procedure would focus attention on some of the inadequacies of both types of estimates and would add considerably to our knowledge of annual variations in the national income, regardless of which method provides the more reliable total.

CLARK WARBURTON

Federal Deposit Insurance Corporation

AN INTERNATIONAL CONVENTION ON STATISTICS OF WAGES AND HOURS OF WORK

At the recent session of the International Labour Conference, at which 50 countries were represented, a draft Convention was adopted (by 125 votes to none against) dealing with the compilation of statistics of wages and hours of work. A preparatory technical Conference of Government Statisticians was held in September, 1937 in order to consider the scope and contents of such a Convention and the proposals which it made were adopted substantially by the International Labour Conference (which includes not only Government representatives but representatives of employers and workers).

The Convention is limited to the mining and manufacturing industries

(including building and construction) and to agriculture, and is also limited to wage earners. Thus, salaried employees and branches such as commerce are excluded. This is due to the special difficulties in compiling statistics for workers in these groups. Separate parts of the Convention deal respectively with (1) statistics of earnings and of hours actually worked in the mining and manufacturing industries; (2) statistics of wage-rates and of normal hours of work in these industries; and (3) statistics of wages and hours of work in agriculture. For mining and manufacturing industries, the statistics are to be compiled and published at least once a year, and in more detail particularly as regards sex and for adults and juveniles at least every three years. For agriculture, the provisions are more flexible and statistics of wages and hours are to be compiled at least once every two years.

In view of the preference in certain countries for statistics of rates over statistics of earnings, or vice versa, provision is made for countries to exclude from their ratification either the part dealing with earnings and hours worked or the part dealing with rates and normal hours, but not both; the part relating to agriculture may also be excluded.

The Convention also provides that it is not necessary to exercise compulsory powers, where such do not exist, and information need not be published which would disclose information relating to any particular establishment. The Convention comes into force twelve months after the date on which two countries have ratified it

Reference should be made to the valuable assistance rendered in the preparation of this Convention by members of the American Statistical Association. Mr. Lubin, Commissioner of Labor Statistics, was the U. S. Government representative at the Preparatory Technical Conference of Government Statisticians, and Mr. Hinrichs, Chief Economist of the Bureau of Labor Statistics, was the Technical Adviser to the U. S. Government delegation to the International Labour Conference, and Chairman of the Drafting Committee of the Conference's Committee on Statistics of Wages and Hours of Work.

J. W. NIXON

International Labour Office
Geneva, Switzerland

PROGRESS OF WORK IN THE CENSUS BUREAU

CENSUS SURVEY OF BUSINESS

The Bureau of the Census is now publishing the results of a survey or sample census of retail and wholesale trade covering the year 1937 and the first half of the year 1938. This was a mail canvass, the main purpose of which was to provide indexes of change in these lines of business activity since the 1935 Census of Business. Like that census, the survey was financed from funds provided by the Works Progress Administration and was conducted in the city of Philadelphia by persons on relief rolls working under

the direction of officials of the Census Bureau. The mailing list was made up of stores reporting in the census of 1935, omitting those retail stores that reported annual sales below \$5,000 and those wholesale stores that reported annual sales below \$25,000. The items on the questionnaire included the net sales in each quarter of 1937 and in the first and second quarters in 1938; the total pay roll in 1937 and in the first half of 1938; and stocks on hand December 31, 1936, and December 31, 1937. The information covers identical establishments or, in other words, establishments that were included in the census of 1935 as well as in the survey of 1937-38. About 250,000 acceptable schedules were secured.

The Bureau has now (December 1) issued all the preliminary reports and expects to complete the final series by January 1. These reports, it is pointed out, are not designed to present a complete picture of the trade. The reporting was voluntary and many stores failed to cooperate or delayed their returns until beyond the closing date, July 1. The great value of the survey is in showing trends. The returns thus far received indicate considerable or large increases of sales between 1935 and 1937 followed by decreases in the first half of 1938 as compared with the first half of 1937.

COMPARABLE OCCUPATION STATISTICS, 1870 TO 1930

Because of changes in classifications and definitions, deficiencies in the enumeration, and other reasons, the existing census statistics of occupations do not furnish a satisfactory basis for determining and measuring changes and trends in the occupational distribution of the nation's gainful workers. To remedy this situation the Bureau of the Census now has in preparation a report designed to present a consistent and comparable occupational classification covering the decennial censuses from 1870 to 1930 and corresponding as nearly as possible to the classification used in 1930. This involves more than a rearrangement or consolidation or breaking down of the occupation groups reported in the successive censuses. It is necessary to allow for the effect of such factors as changes in the instructions defining the term gainful worker, especially as applied to women and children; changes in the date of the census from June in 1900 to April in 1910, to January in 1920, and back to April in 1930; the early growth of occupations, such as that of "electrician," which were in existence for some time before they secured recognition in the census; the allocation of the comprehensive, indefinite group "laborers not specified" in earlier censuses to the several main divisions of occupations which are separately shown in the 1930 census—these and other factors necessitate making many estimates and readjustments in order to ensure comparability.

The work has reached the point where two press releases have been issued, one giving comparable statistics for the established ten main divisions of occupations in the Census classification, and the other giving a classification of gainful workers by age. The final report giving statistics in detail by occupations is well under way.

TRIAL CENSUS OF AGRICULTURE

With the cooperation of the United States Department of Agriculture the Bureau of the Census has conducted a trial census of agriculture in 90 counties distributed in 40 states and covering about 3,000 farms.

The State statisticians of the Department of Agriculture made the actual enumeration and forwarded the schedules to the Census Bureau for tabulation and analysis. They then made written reports to the Bureau upon all items of interest connected with the enumeration, including comments on the schedule questions themselves, the time required, reaction of the farmer to certain questions, the relative accuracy of replies obtained, the difficulty of obtaining certain information and other pertinent facts. These reports have been summarized by the Census staff so that all feasible improvements and suggestions may be adopted; and a series of press releases has been issued giving some of the interesting results brought out by a tabulation of the data.

The primary purpose of this census was to test out the proposed new questions for the agriculture census of 1940. Unforeseen difficulties are likely to arise in connection with any new census question, and the only real test of whether it can be answered satisfactorily by the census enumerators is actual field experience. The trial schedule included most of the satisfactory and necessary questions carried in the 1930 and 1935 censuses, as well as the new questions.

The Bureau is planning to conduct similar test censuses for population.

J. A. H.

STATISTICAL NEWS AND NOTES

Securities and Exchange Commission

As of July 1, 1938, most of the personnel and activities of the former Research Division were transferred to the Research and Statistics Section of the Trading and Exchange Division.

The first installment of the Commission's study of investment trusts and investment companies, which has been in preparation since early in 1936, was released on June 10, 1938. Up to the end of October the introductory Part One and the first five chapters of Part Two had been made available to the public. These chapters contain detailed statistical material, generally from 1927 through 1936, on the balance sheets and income accounts of investment trusts and companies, sales and repurchases of their own securities by investment trusts and companies, trading in the securities of these organizations on exchanges and the distribution of ownership of their own securities. The remaining statistical chapters covering mainly performance of investment trusts and companies and the nature of and changes in their security investments are expected to be released during the winter.

The analysis of the financial statements filed by approximately 2,000 corporations under the Securities Exchange Act of 1934, which has been undertaken under the Commission's supervision in the W. P. A. project "Census of Listed American Corporations," is nearing completion. It is expected that reports covering the years 1934 through 1937 will be released for about 30 major industries and for all companies included in the census. Releases are scheduled to start around the end of the year and to continue for about six months. The data to be released for each industry include combined balance sheets, profit and loss accounts and surplus reconciliation statements for each of the four years; volume of sales; selected asset and income relationships; list of parents and subsidiaries; detailed information on securities outstanding and certain information on remuneration of management.

Board of Governors of the Federal Reserve System

The *Federal Reserve Bulletin* for October 1938 contains a statistical analysis of branch banking in the United States at the end of 1937. This analysis includes the number of banking offices, the number of banks operating branches, and the number of branches, by class of banks, by location of branches relative to head office, and by States and geographic divisions. It also includes material relating to the size of banks operating branches, the population of towns or cities in which they are located, and the extensiveness of various branch systems. A revised historical table of branch banking, 1900-1937, is also included.

Farm Credit Administration

Effective October 1, 1938, a Division of Research was created in the Farm Credit Administration under the jurisdiction of Dr. E. A. Stokdyk, recently appointed Deputy Governor. Prior to this date, research was carried on by two units, the Economics Subdivision of the Division of Finance and Research, now the Division of Finance and Accounts, and the Research, Service, and Educational Subdivision of the Cooperative Division. These subdivisions have been transferred to the Division of Research and now carry the titles, Economics and Credit Research Subdivision and Cooperative Research and Service Subdivision. The former is engaged in research relating to the credit problems of farmers and the latter in research on problems of farmer's cooperative associations.

Bureau of Agricultural Economics

The changes in the structure of the United States Department of Agriculture announced by Secretary Wallace in the early part of October unify several lines of work in the Department and vitally affect the work and organization of the Bureau of Agricultural Economics. Dr. H. R. Tolley leaves the post of Administrator of the Agricultural Adjustment Administration to become Chief of the reconstituted Bureau of Agricultural Economics and A. G. Black, former Chief of the Bureau of Agricultural Economics, becomes Director of Marketing and Regulatory Work. The Bureau of Agricultural Economics will have Department-wide responsibility in the formation of programs and plans to guide the entire group of agricultural adjustment, conservation, and marketing services to farmers and the general public. The Program Planning Division and the general planning for marketing programs heretofore in the Agricultural Adjustment Administration, the general land-use planning functions under the Flood Control Acts, Water Facilities Act, forestry programs including farm forestry, wildlife conservation program, tenancy and rehabilitation programs, and erosion control programs have all been transferred to the Bureau of Agricultural Economics. However, some duties have been transferred from the Bureau of Agricultural Economics to other Bureaus. All marketing service, and regulatory work in connection with cotton; dairy and poultry products; fruits and vegetables; grain; livestock; meats and wool; hay, feed, and seed; warehousing; tobacco; market news service; and the Division of Crop and Livestock Estimates will be transferred to one of the four agencies under the Director of Marketing and Regulatory Work.

A project of estimating income parity for agriculture was begun in the spring of 1936 following the presentation of the problem in the Soil Conservation and Domestic Allotment Act of Congress. In response to this legislation, historical prices were collected for the base period 1910 to 1914, surveys were made of farmers' expenditures to supplement existing data, and data gathered on farmers' income from non-farm sources. Weights were also calculated

from a consumer survey. Parity was redefined in the Agricultural Adjustment Act of 1938 and this reduced the project requirements to a comparison of incomes without measuring purchasing power, and also restricts comparison to farm income from farm operations exclusive of income to farmers from non-farm sources. The project is a cooperative enterprise with the A. A. A. the Bureau of Home Economics, and the Bureau of Agricultural Economics participating. The estimates of income from agriculture and of agricultural wealth are being prepared under the direction of a committee composed of members of these three organizations with Dr. O. C. Stine, Bureau of Agricultural Economics, as Chairman and Mr. C. M. Purves, Bureau of Agricultural Economics, as Secretary. The Central Statistical Board has also participated in planning and developing this project, being represented by Dr. Morris A. Copeland and Mr. Edwin M. Martin as members of the Board staff.

The results of the study will first be published in a series of preliminary reports or sections under the following four parts: Part I—Farm Income; Part II—Expenses of Agricultural Production; Part III—Prices Paid by Farmers for Commodities and Services; and Part IV—Income to Farmers from Non-Farm Sources.

As soon as possible after these preliminary estimates are completed, they will be summarized in one publication together with a comparison of the net income to farmers with the available data of income to non-farmers.

In connection with farm income estimates, a recent memorandum from the office of the Chief of the Bureau of Agricultural Economics stated that the Division of Statistical and Historical Research will have charge of the "preparation and publication of monthly and annual estimates and forecasts of farm income and wealth, for coordinating these estimates with national income estimates, and for analyzing and explaining the significance of and the reasons for changes in farm income and wealth."

Interstate Commerce Commission

The Interstate Commerce Commission has made a beginning in the collection of statistics of motor carriers by the adoption on August 1, 1938, of forms for quarterly reports of revenues, expenses, and statistics of motor carriers of property and motor carriers of passengers subject to its jurisdiction. The first report is for the quarter ended September 30, 1938. A brief monthly form was also prescribed for motor carriers of passengers.

Bureau of Foreign and Domestic Commerce

A series of charts showing the relative position of goods passing into the hands of the consumer through independent drug and jewelry stores and through lumber and building material dealers has recently been prepared by the Marketing Research Division. The charts portray this movement during each month of 1936 and 1937 and are based upon sales information collected monthly from a sample group of stores in particular states reporting in the

Bureau's Current Trade Statistical Program. Data are shown for twelve mid-western and southwestern states for lumber and building and for drug outlets. Nine states in the same geographical areas are covered for jewelry stores. A table showing the percentage distribution of wholesale sales for eighteen kinds of business over the same period is also available.

The field work has been completed in the Bureau's compilation and analysis of income data and related information such as age, years of practice, type of practice, and location for dentists, osteopathic physicians, chiropractors, chiroprodists, and miscellaneous curative professions (excluding the medical profession and nursing). The results are now being analyzed and it is expected that a report will be ready by the end of the present calendar year. This project is conducted under funds made available by the Works Progress Administration for research projects.

An estimate of the dollar sales of men's clothing in department stores for the nine-year period, 1929-1937, has recently been made. These estimates are based upon information collected in connection with the Bureau's Current Trade Reporting Program. A progress report upon this program recently appeared in the *Survey of Current Business*, reprints of which are available upon request.

Bureau of Labor Statistics, U. S. Department of Labor

The Retail Price Division has adopted new specifications for use in food pricing. Preparations are being made for the annual conference of retail price field representatives, to be held in Washington from January 23 to February 8. The program will include a review of the year's work in pricing clothing, on the basis of specifications discussed at last year's conference. There will be study of the new specifications developed for drugs, toiletries and soap, and for shoes.

There are available in mimeographed form surveys of wages, hours, and working conditions in three industries for which it will not be possible to publish printed bulletins. They cover cotton goods, soap, and radio receivers. The November issue of the *Monthly Labor Review* carried summary reports on the furniture study and the comparison of annual earnings of navy yards and private ship yards. Later issues of the *Review* will carry articles on the fertilizer industry, paid vacations in industry, and the annual survey of entrance rates of common labor as of July 1. Studies of wages and hours have been undertaken for boots and shoes, foundries and machine shops, and knit goods and hosiery, and work is nearing completion on the surveys for iron and steel, electrical manufacturing and apparatus, meat packing, woolen and worsted, and dyeing and finishing.

The Division of Construction and Public Employment will conduct a W. P. A. project whose objectives are (1) to secure from state, county, and city records statistics relating to number of hours, number of employees, and amount of pay rolls, by pay-roll periods; and (2) to obtain the same type of data from contractors performing work for these political subdivisions

and whose employees are not hired directly by these divisions. A technical committee composed of representatives of several government agencies will supervise the plans for the project. Every state, all cities over 100,000 population, and a selected sample of smaller cities and of rural counties will be covered; public employees for each county in which a sample city is located will also be included. It is planned that the Bureau will collect statistics of public employment as a regular feature of its work after the conclusion of the project. A study of labor requirements in the machinery and machine-tool industries has been undertaken.

Indexes of employment and pay rolls adjusted to the 1935 Census of Manufacturers have been released in mimeographed form under date of September 1938. The indexes have been revised for the period 1919 to 1938, in order to take into account several revisions in industrial classification as adopted by the Census Bureau. These changes are described in the release containing the revised indexes.

United States Employment Service

During the course of its operations in recent years the United States Employment Service has made several cross-section inventories of all registrants actively seeking work through affiliated employment offices. During recent periods these complete national inventories have been supplemented by sample studies. The widespread inauguration of unemployment compensation benefit payments in January 1938, however, presented a problem in sampling due to the wide divergence of conditions in the states which were paying unemployment compensation benefits and those which were not.

In order to meet this situation a new sampling method has been followed, two sample groups of states being selected to estimate the distribution of trends of the registered job-seekers in the Employment Service. One sample was used to demonstrate what the behavior of the active file would have been if all states had begun payment of unemployment compensation benefits in January 1938. The other was selected to fulfill the opposite circumstance; viz., if no states had begun such payment. The "benefit" sample comprised the following states (all of which began payments in January 1938): Maryland, Minnesota, Rhode Island, Arizona, Utah, and Louisiana. This sample had a validity (r) of .9622. The "non-benefit" sample was made up of five states, none of which had begun payments. They were: Nevada, Delaware, Washington, Missouri, and Colorado. This sample had a validity (r) of .9147.

In addition, two other samples have been selected. The first comprised twelve states, to be used after all states have begun the payment of unemployment compensation as a substitute for complete active file inventories. The sample with a validity (r) of .9941 was composed of the following states: Delaware, Utah, Nevada, Maryland, Wisconsin, Arizona, Colorado, Rhode Island, Louisiana, Washington, Connecticut, and Nebraska. The other

sample was designed as an interim measure to provide for surveys on the basis of the "benefit-paying" hypothesis until the main sample can be used. This sample of eight states has a validity (r) of .9934. The states are: Wisconsin, Maryland, Connecticut, Louisiana, Minnesota, Arizona, New Hampshire, District of Columbia, and Utah.

The technique used to select these samples was primarily a minimizing function which selected the state whose occupational statistics were most similar to those of the United States. Repeated applications of the function made it possible to add successively those states which, when added to previously selected states, would most nearly approximate the United States distribution. A more detailed exposition of this technique is being prepared for publication.

Bureau of Research and Statistics, Social Security Board

The Division of Public Assistance Research recently expanded the scope of its statistical reporting program to include financial statistics relating to (1) administrative expenses, (2) relative amounts of Federal, State, and local funds used to finance public assistance and relief expenditures, and (3) revenue sources of State and local funds. The reporting system which provides for semiannual reports by State public welfare agencies is being introduced on an experimental basis during the six-months period ending December 31, 1938. More than one-half of the State agencies have already indicated their interest in and their willingness to cooperate in this experiment. One of the principal problems associated with the preparation of these data is that of arriving at a satisfactory method of apportioning administrative expense among the different programs administered by a State public-welfare agency. The Division is preparing material for the use of State agencies in developing adequate and sound procedures for carrying on time studies which can be used to make such an apportionment. From experience gained during the experimental period revisions in the original plan will be made and more adequate underlying procedures and techniques developed.

Monthly reports submitted by public and private relief agencies in the 116 urban areas included in the trend of urban relief from 1929 to date have been revised and corrected through December 1937. Revised figures for the trend of relief in each individual area, as well as for the United States total, are now available. The total amount of obligations incurred and the amount per inhabitant for the calendar year 1937 were published in the *Social Security Bulletin* for September 1938. An article by Anne E. Geddes on *Relief Trends in Cambridge, Massachusetts, 1929-1937*, based on the data collected for this series, appeared in the *Social Security Bulletin* for August 1938. The data collected in this series also furnished the basis of an article on a *Seasonal Index of Urban Relief* by Helen R. Jeter and Herman W. Gruber which appeared in the July issue of the *Social Security Bulletin*.

Bureau Report No. 1, *Tabular Summary of Statistics of Public Assistance under the Social Security Act for the Calendar Year 1937*, and Bureau Report

No. 2, *A Plan for a Case Census of Recipients of Public Assistance*, will shortly be available for distribution. Bureau Report No. 1 presents monthly data on the special types of public assistance by States for the calendar year 1937 and the number of recipients of the special types of public assistance and the amount of obligations incurred for payments to recipients, by counties for December 1937. Bureau Report No. 2, prepared by Margaret C. Klem, is a manual for the use of State and local welfare agencies interested in conducting a case census.

The Division of Public Assistance Research has completed a chart on the organization for the administration of general relief as of December 1937. This will be published in the *Social Security Bulletin* for November 1938.

The analysis of the 1937 and 1938 annual reports to the Social Security Board, from State agencies administering public assistance, about the social characteristics of recipients of the special types of public assistance will appear in a series of articles in the *Social Security Bulletin*; these articles will then be reprinted in a single publication.

With a view to greater simplification of administration of unemployment insurance, a comprehensive study is now being made of the experience gained by the States. A representative sample of workers' wage records was obtained from the Maryland unemployment compensation agency, and an extensive series of runs were made of these data. Similar data from the Minnesota agency are being processed. The tables were designed to test the various benefit formulae and their component parts, eligibility, benefit rate, and potential duration of benefits. Tests were made of the differences between use of full-time weekly wage compared with use of 1/13 of the highest quarter's earnings as an alternative to the full-time weekly wage. Various runs were made to test the effect of varying types of base periods. In addition to these data, samples of claim and benefit-payment records for individuals whose benefit rights were exhausted were secured from Rhode Island. Runs of these cards are in process. It is expected that an outline presenting the various alternative simplification procedures will be presented at the Interstate Conference of Unemployment Compensation Agencies, to be held in Washington, October 20-23.

Coincident with the work on simplification of unemployment compensation administration, the Bureau has been reviewing the Board's statistical-reporting requirements. A conference was held August 17-20 in Washington with the Technical Subcommittee of the Committee on Research and Statistics of the Interstate Conference. Mr. Meredith B. Givens, Director of Research and Statistics of the New York unemployment compensation agency, presided. A number of recommendations were drafted and the Bureau has been preparing a revision of the statistical requirements along the lines suggested. These suggested revisions will soon be forwarded to State statisticians for comment and criticism. The revised benefit statistics reflect greater refinement than was feasible when the statistical-reporting program was initiated.

In connection with a comparison of relative economic resources and wel-

fare needs of the States, the Division of Economic Studies cooperated with the Price Section of the Bureau of Agricultural Economics in developing State differentials in the prices paid for living by farmers. These differentials were recently released by that Bureau. The Division of Economic Studies is also cooperating with the Bureau of Agricultural Economics, the Bureau of Labor Statistics, and the Works Progress Administration in exploring the possibility of developing comparable cost of living data for rural and urban areas.

The Division of Health Studies is engaged in research concerned with the problem of health security. A number of studies are in progress to determine sickness and disability rates in the United States. These studies draw upon the experience under various foreign plans of health insurance and upon data available from voluntary health insurance and sickness surveys in the United States.

Data are being gathered on the cost of medical care for families of different income levels and likewise the cost of medical care under various insurance plans. Studies are in process of the actuarial experience, i.e., demand for medical service under insurance plans.

Bureau of Old-Age Insurance, Social Security Board

In the September issue of this JOURNAL a statement of the statistical program of the Bureau of Old-Age Insurance was published. Some of the studies mentioned in that issue have now been completed and others are in process.

The study of the Adjustment of the 1930 Census Enumeration of Gainful Workers to the Statutory Coverage of the Social Security Act has been mimeographed and distributed to a limited number of officials of the Board.

Tabulation of the first installment of 1937 Employer Returns has been completed and the results were published in the September issue of the *Social Security Bulletin*. Distributions of number of employers, number of wage items, and amount of wages were presented by size of firm, as indicated by the number of employee wage items on employers' returns. This first tabulation was made on a basis of reporting organization and, in the case of multi-establishment employers, no attempt was made to proportion the total amount of employment and wages to the individual establishment. According to the present plans, the second installment will give this latter information in a cross tabulation by city, by size classes within each State, and by State within major industry group. The proposed plans for the tabulation of 1937 data for individual employees include distributions by age, sex, race, and earnings within the State in which each employee was working during the second half of the year. Employees found to have been working at some time during the year in States other than those in which their account numbers were assigned are considered as migrants, and a cross tabulation between States of emigration and immigration will be made.

A preliminary tabulation of the non-migrants by age, sex, race, and earnings is about half completed.

All employers' applications for identification numbers are now being coded both for industry and for geographical location, as a basis for statistical tabulations. In this connection a special geographical code has been constructed.

The Claims Punch Cards which were mentioned in the September issue of this JOURNAL have been ordered. All plans for copying, coding, and punching claims data have been completed. This project will be under production very shortly, and will be a source of statistical data showing the characteristics of wage earners who have died or attained the age of 65. For example—their sex, color, age, marital status, last occupation, and wages will be available. A limited amount of data pertaining to survivors may also be obtained from these cards, such as their number and relationship to the wage earner and the amount of funeral and last illness expenses paid by the claimant.

*Division of Statistics and Economic Research,
Works Progress Administration*

A review of the statistical needs of the state WPA Administrations is being made. As part of this review, a series of regional meetings of state statisticians is being held in the WPA Regional Offices. These meetings are devoted to a discussion of the types of statistical data found useful in administering the WPA in the states and the procedures used in compiling such data. A new monthly report was inaugurated by the WPA in May. The report shows accessions and separations of persons certified for employment on WPA projects and constitutes the basis for a monthly series of WPA labor turnover rates.

Data on the physical accomplishment of WPA projects through June 30, 1938, are being tabulated and will be available soon.

Division of Social Research, Works Progress Administration

Depressed Areas. A recently approved survey will be devoted to the study of the "hard core" of relief and the problem of the long-time unemployed as exemplified by the population in areas where there has been a prolonged dislocation of the basic industry or industries. The survey will attempt to determine the nature and causes of these dislocations, the effect upon the population, and the practicability of proposals for rehabilitating these areas. Exploratory field investigations have been made in New Bedford, Massachusetts, and in Southern Illinois with a view to perfecting procedures to be used in these and other areas.

Study of Rural Problem and Non-Problem Areas. Independently of the rural farm areas, 173 non-farm areas have been tentatively established. Basic criteria used in this procedure include the proportion of gainful workers in various industries, together with a plane of living index and population fertility ratio. Rural non-farm areas vary in type from isolated rural indus-

trial communities to large cut over areas, mining areas and manufacturing districts.

The two series are being compared in an effort to combine them into homogeneous areas which will include both rural farm and non-farm population.

Concepts Used in Unemployment Surveys. As a result of an examination of some 40 enumerative studies of unemployment made since 1930 a memorandum has been prepared discussing the concepts used in measuring unemployment. The memorandum is divided into two parts. The first part attempts to evaluate the concepts most usually found in terms of their effectiveness both in field enumeration and in providing information that is comparable from survey to the next. In the second part of the memorandum a plan for making enumerative studies is proposed which attempts to avoid many of the difficulties that are inherent in the concepts that have heretofore been employed. A limited number of mimeographed copies of this memorandum have been prepared and are available to those interested in the problems of unemployment surveys.

A Study of Rural Youth Adjustment. A detailed study is in progress to show the adjustments rural youth have made since 1929. This survey will provide separate analyses of youth who have migrated to the cities and of youth who have remained in agricultural and rural industrial areas.

Rural Population Mobility in the United States. To provide a better understanding of the extent and nature of rural population mobility in the United States a comprehensive report of rural population movements in relation to significant social and economic factors is being prepared. The report will include chapters on the major types of rural population mobility; provide, in historical sequence, descriptions of major rural population movements before 1930 and farm movements since 1930; and present an intensive analysis of rural migration during the decade 1920-1930.

Housing Surveys. Instructions for conducting low-income housing area surveys are being prepared by the Division in cooperation with the U. S. Housing Authority and the Federal Housing Administration. The survey will provide data on family composition, the annual incomes of each member of the household, and the location of employment relative to residence of each gainfully occupied member. The information is designed for use by local housing authorities to determine the number of families living in substandard dwelling units who are eligible for rehousing under the terms of the act creating the U. S. Housing Authority. Substandard dwelling units will be located in the course of real property surveys which are to be conducted in conjunction with this survey. Real property surveys are now operating as WPA projects in more than 25 cities, and low-income housing area surveys are to be conducted in a majority of these.

Resurgence of interest in housing surveys has led to the preparation of a summary of the real property surveys conducted in the years 1934-1936. This will be published by the Division of Social Research under the title of

Urban Housing: A Summary of Real Property Inventories Conducted as Work Projects, 1934-1936.

Agricultural Experiment Station of the A & M College of Texas

With the cooperation of the Works Progress and Farm Security Administrations, studies of recent changes in farm tenancy and farm labor are under way. The relation of recent farm mechanization and crop control to the problems being studied is being given special attention. This study will cover approximately 450 large scale farms and plantations located in 26 different counties where cotton is the major farm enterprise. In addition to a record of mechanization and farm organization changes on these large farms, approximately 500 records covering the status, mobility, employment, housing, incomes and related data on farm laborers and their families will be obtained. Mr. W. C. Holley, Assistant State Supervisor of Rural Research, WPA, is in active charge of the field work on this project.

Another cooperative project, with the Agricultural Adjustment Administration, will begin October 15. This project provides for further study of cropping systems and farm rental arrangements in relation to the agricultural adjustment programs.

A paper on "Texas Farm Tenure Activities" has been published in the *Journal of Land Public Utility Economics* for August, 1938. Reprints will be mailed to those who write to the Experiment Station, College Station, Texas, requesting them.

Research Projects at Dun & Bradstreet, Inc.

1939 Business Trend Survey. Plans are being made for a repetition of the Business Trend Survey made last year. The questionnaires will go out about January first to over 2,000,000 business concerns listed in the *Dun & Bradstreet Reference Book*, asking trend of sales and inventories for 1938 as compared with 1937.

In addition, it is expected that some questions will be added in an effort to measure the tax burden of industry, particularly the differences in the impact of taxes on large and small enterprises and the differences between various trades and industries. The results are expected to be available sometime in March, 1939.

Surveys of Wholesalers' Operating Costs. Three of the surveys discussed in the June issue of this JOURNAL have been carried forward and are expected to be ready for distribution in November. These are the reports covering the following trades: Paint and Varnish, Dry Goods, and Automotive and Equipment.

National Bureau of Economic Research, Inc.

As a result of a decision by the Board of Directors of the National Bureau to extend the representation of universities in its membership, two universities have made nominations: Minnesota and North Carolina. On October 20, the Executive Committee of the National Bureau elected Guy

Stanton Ford, President of the University of Minnesota, and Frank P. Graham, President of the University of North Carolina, to serve as Directors by University Appointment.

A Committee on Cooperative Research has been appointed by the Executive Committee, after nomination by the respective universities, to supervise the cooperative program of the National Bureau and especially its relations with university research. The members are: California, R. D. Calkins (alternate, M. R. Benedict); Chicago, Jacob Viner (alternate, S. E. Leland); Columbia, J. C. Bonbright (alternate, Carter Goodrich); Harvard, John D. Black (alternate, Alvin H. Hansen); Michigan, I. L. Sharfman (alternate, W. A. Paton); Minnesota, R. A. Stevenson (alternate, R. G. Blakey); North Carolina, Eric W. Zimmerman (alternate, Clarence Heer); Pennsylvania, Anne Bezanson (alternate, William J. Carson); Stanford, Joseph S. Davis (alternate, Norman J. Silberling); Wisconsin, Martin G. Glaeser (alternate, Harold M. Groves); National Bureau of Economic Research, Wesley C. Mitchell (alternate, Simon Kuznets). Additional members may from time to time be designated by the National Bureau for special purposes.

The first of the industry committee reports, *Prices in the Bituminous Coal Industry*, has been issued. Reports are expected from the other five committees on iron and steel, oil, automobiles, textiles, and distribution costs and pricing policies at retail. A standing committee on Cost-Price Relationships is being formed under the chairmanship of E. S. Mason of Harvard University. An outgrowth of the coal report is the creation of a standing committee to deal with price problems of the bituminous coal industry. W. E. Fisher of the University of Pennsylvania is chairman.

National Industrial Conference Board

Continuing its *Studies in Personnel Policy*, the National Industrial Conference Board recently issued the eighth and ninth in the series. "Plans for Rating Employees" deals with information received from 94 companies as to periodic appraisals of employees. Tables show the distribution of rating systems, the percentage of employees affected, and various company practices in making ratings. In "Health Insurance in Industry—Mutual Benefit Associations," the Board has tabulated returns from 277 companies on prevailing policies in the administration of benefit societies. Statistical information is given about the amount of dues, the size of benefits, the types of benefit payments, membership requirements, and other features of benefit associations in various companies. A further study in this field is now in progress and will cover group health insurance and company non-contributory disability benefit plans for wage earners. A survey of company public relations activities is also being conducted, and the results will soon be published.

The Board's study of "Cost of Government in the United States, 1935-1937," is another in a series of exhaustive analyses of public finance. In this

163-page book are discussed governmental expenditures, tax collections, the federal deficit, public debt, and social security finances. An appendix contains valuable data as to the sources and methods used in compiling the statistical material.

In addition to its regular monthly studies of earnings, hours, and employment in manufacturing industries, the Board assembled a summary of such material in a recent publication entitled, "Wages, Hours and Employment in the United States, July, 1936-December, 1937." Extensive statistical discussions are contained in another publication, "Revised Estimates of Employment and Unemployment," in which are included some notes as to the methods of estimating employment.

Data from 74 cities are contained in the article on "Local Variations in the Cost of Living," a continuation of the Conference Board's actual cost figures for maintaining a given standard of living in a large number of American communities.

It is expected that a book on the economic position of Russia will soon be published, containing the results of the Board's investigations of the Soviet economy. Other studies in progress include research on the availability of bank credit; an article on the national finances of the United Kingdom; a survey of depression and recovery in the United Kingdom; a report on income distribution in the United States and foreign countries; a summary of the Walsh-Healy Act decisions; and a brief study of the salaries of corporation executives.

The Twentieth Century Fund

Early in November The Twentieth Century Fund will publish a book entitled "Debts and Recovery," which reports the results of a study of changes in the internal debt structure of the United States during the depression and recovery years. Albert G. Hart, of the University of Chicago, was director of the study.

The study of the economic effects of short selling on the New York Stock Exchange, under the direction of Dr. Fred R. Macaulay, is continuing, and a large amount of material never before available regarding the short position and the volume and timing of short selling operations has been assembled and is being analyzed. The report will not appear until after the end of the year.

The study of "Distribution and Its Costs" is in final manuscript form and, upon approval by the Fund's Committee on Distribution, it will be ready to send to the printer. This study is based upon an extensive analysis of Census of Distribution data, and will probably be published some time before the end of the year.

CHAPTER ACTIVITIES

The Albany Chapter

The Albany Chapter had an unusual meeting on October 25: a tour through the Division of Placement and Unemployment Insurance of the New York State Department of Labor while the staff of the Division was at work. The tour was conducted by Mr. Milton Bass and Mr. C. M. Armstrong, with detailed explanations and demonstrations of the operations required in handling the wage records of the more than 3.5 million employees that are on file and the claims for unemployment benefits that have ranged from about 120,000 to nearly 400,000 per week since January 29. This work utilizes punched card tabulation very extensively for many of the steps of recording and computing. About 50 persons were present at these demonstrations.

Following this, a dinner meeting was attended by 53 persons, making a total attendance altogether of about 75 people. Mr. Bass and Mr. Armstrong gave a further brief discussion of the application of mechanical tabulation to the Unemployment Insurance activities, followed by questions and answers.

Mr. Armstrong also discussed briefly the presentation made on behalf of statisticians in state service at the hearing of appeals by the Temporary Salary Standardization Board of New York State with reference to salary allocations for the various grades of statisticians. Particular attention was given at this hearing to the question as to whether statisticians should properly be allocated as professional workers. The work of the Chapter's Committee on Professional Standards for Statisticians in New York State Service was reviewed by Dr. R. L. Gillett, and the preliminary report of the Committee was presented. This report stresses the need for thoroughly trained workers in statistics in the public service and outlines some minimum qualifications that are believed essential for professional workers selected through Civil Service examinations, including broad fundamental training.

The Austin Chapter

The Austin Chapter held its first regular meeting of the current academic year on October 21. Dr. C. T. Gray, Professor of Educational Psychology at the University of Texas, presented an address on "Statistical Problems in Education."

The Chicago Chapter

For the first meeting of the 1938-39 season, the Chicago Chapter on October 18 joined the local organization of the American Marketing Association to hear Mr. W. S. Townsend, President of Townsend and Townsend, Inc., New York, Advertising Counsellors. Mr. Townsend spoke on the scientific measurement of advertising.

In discussing the research which led to the selection of the 27 points used in the Townsend system to evaluate the effectiveness of an advertisement before it is published, Mr. Townsend compared these 27 factors to a football team in which each has a definite function to perform, in a certain sequence. If some players are left sitting on the bench instead of being used in the line-up, the effectiveness of the team is impaired to that extent.

Mr. Townsend expressed the conviction that advertising is a much more potent factor than is generally recognized. By using it more effectively to create more sales, thus increasing production, it would help to solve the problem of unemployment.

The Cincinnati Chapter

Mr. Procter Thomson, of the Chemical Division of Procter and Gamble Company, addressed the Chapter on "Industrial Applications of Statistical Method," at the first fall meeting on November 3. Mr. Thomson told how statistical methods were being used to standardize important chemical procedures in the manufacturing department of his company.

The Cleveland Chapter

The first meeting for the season of the Business Statistics Section of the Cleveland Chapter was held on September 26. Sixteen members and guests were present. Mr. K. H. MacKenzie of the Cleveland Federal Reserve Bank was chosen as Chairman. Mr. W. T. Diebold of The Ohio Bell Telephone Company was reelected Secretary. The meeting was devoted to a forecast of the Federal Reserve Board's index of industrial production for the next twelve months. Ten members presented estimates. Four of the ten predicted an increase during the year of 20 per cent, one forecast a 30 per cent increase, and the remaining five predicted little change.

The Connecticut Chapter

A meeting of the Connecticut Chapter was held on October 4 at which Mr. Frederick F. Stephan, Secretary of the American Statistical Association, spoke on "Changing Demands for Statistics and Statisticians."

The Lehigh Valley Statistical Society

On October 21, Mr. G. A. Roush, nationally known student of mineral statistics, spoke to the Chapter on his experiences of editing *The Mineral Industry*, an annual volume presenting and interpreting mineral statistics. Professor Allison Butts, of Lehigh University, who has written one chapter in the volume in recent years, opened the discussion.

The Philadelphia Chapter

"Capital Financing and Business Recovery" was the topic for the meeting of the Chapter on May 20. Dr. George Terborgh spoke on "The Need for

New Capital," and Dr. Claude L. Benner on "Some Factors Controlling the Demand for Capital."

The Philadelphia Chapter held its first meeting of the 1938-39 season on October 28, the subject for which was "Developing a Factual Basis for Collective Bargaining: A Review of the Experience of the Hosiery Industry." Dr. George W. Taylor, Impartial Chairman, Hosiery Industry, discussed "The Industry-Wide Collective Agreement," bringing out the way in which the industry wage policy is formulated and administered in relation to a research program. Mr. Alfred Hoffman, Research Director of the American Federation of Hosiery Workers, spoke on "The Union Research Department," explaining the facts which assist a union in achieving high wages and low labor costs. The third speaker was Mr. F. D. MacIver, Vice-President, Phoenix Hosiery Company, who presented "A Personnel Program for a Unionized Plant," with particular reference to the use of records in "bargaining" over such matters as promotions, lay-offs, piece-rates, and time-rates.

The Pittsburgh Chapter

A discussion on "The Effect of the 1937-38 Depression upon Relief Expenditures," led by Mr. Ralph Carr Fletcher, Director of the Bureau of Social Research, Federation of Social Agencies, comprised the program for a meeting of the Chapter on October 27. A number of persons responsible for the administration of relief programs in the community attended the meeting and participated in the discussion.

The San Francisco Chapter

A meeting of the San Francisco Chapter was held on October 20, the general topic for which was "The Business Outlook." Professor Howard Ellis, of the University of California, spoke on "The International Credit Situation." Professor Robert A. Gordon, of the University of California, discussed "Prospects for Expansion in the Capital Goods Industries." Dr. Joseph S. Davis, Director of the Food Research Institute, Stanford University, presented "The Agricultural Outlook." Professor T. J. Kreps, of Stanford University, summarized the speeches, after which there was a general discussion.

The Washington Statistical Society

"The Statistical Basis for a National Health Program" was the subject of the meeting of the Washington Statistical Society held on October 13. Dr. Joseph W. Mountin, of the U. S. Public Health Service, presided. The principal speakers of the evening were: Mr. I. S. Falk, of the Social Security Board, Mr. George St. J. Perrott, of the U. S. Public Health Service, and Dr. Martha Eliot, of the U. S. Children's Bureau.

HARRY JEROME

Harry Jerome, widely known as a worker in statistics and economics, died at Madison, Wisconsin, on September 11, 1938. He was born in Bloomington, Illinois, on March 7, 1886, and graduated from the University of Omaha in 1912. From 1912 to 1914, he taught history and economics at that Institution. Since 1914 he was connected with the University of Wisconsin, where he received a Master of Arts degree in 1915 and a Ph.D. degree in 1918. Since 1920 he was professor of economics and he served as chairman of the Economics Department from 1931 to 1936.

In addition to his work at the University of Wisconsin he had many other interests and working connections. In 1919 and 1920 Dr. Jerome worked as income tax assessor for the Wisconsin Tax Commission, and later taught a course in taxation at the University. From 1923 to 1925 he was on the staff of the National Bureau of Economic Research. For a number of years and until his death he was a director of that Bureau. Though he returned to his teaching at Wisconsin in 1925, he always maintained his connection with the National Bureau of Economic Research, and his last two books were written in conjunction with his work in that organization. These are "Migration and Business Cycles" (1926) and "Mechanization in Industry" (1934).

His textbook, "Statistical Method," appeared in 1924 and was widely used in the teaching of elementary statistics. At the time of his death, Dr. Jerome was engaged in the revision of this early text.

Since September, 1936, he worked almost continuously on a survey of productivity and changing industrial techniques, which was conducted as a national research project of the WPA in cooperation with the National Bureau of Economic Research. This was a continuation and further development of his researches with the same organization in the years 1923 to 1925. For most of a year ending in June of 1937 he directed this work from Philadelphia, being on leave of absence from the University.

Professor Jerome was for many years actively interested in the affairs of the American Statistical Association and the American Economic Association. Only a few months ago he organized the Madison, Wisconsin, Chapter of the American Statistical Association, and he was serving as this Chapter's first president at the time of his death. From the beginning of his work in Wisconsin, he was always interested in state affairs, and he was one of the original members of the Wisconsin Committee on Statistics and an active member of the Advisory Board of the Wisconsin income tax study, which is now in progress. In 1933, he initiated the cost of living survey in Madison which is still being continued.

In addition to being a patient and highly disciplined research worker, Dr. Jerome was a devoted teacher and he always had the confidence of his students. In fact, his work with the student body, especially the graduate group, seems to have brought most strongly into play those rare qualities

which his friends liked so much. Those who really came to know him, loved him, and few men have had the good fortune of having as devoted a following in their students as did Harry Jerome. And it is in his students fully as much as in his writing that his work and his spirit will live on.

In his passing, his profession, his friends, and co-workers have all lost very much. His kindly personality, his modesty, and his simplicity in work and purpose inspired those associated with him. His memory is dear to many who had come to value his counsel and judgment in research and teaching problems.

As a memorial to Professor Jerome, his students, his friends, and co-workers are arranging for contributions to a scholarship fund which is to be established in his name and in recognition of his services at the University of Wisconsin. This fund is in the care of Dr. Edwin E. Witte, chairman of the Wisconsin Department of Economics, and he handles the correspondence regarding this memorial.

WALTER H. EBLING

NEW MEMBERS

- Beum, Corlin O., Jr., Student, Ohio State University, Columbus, Ohio
 Chase, Arnold E, Assistant Statistician, U. S. Bureau of Labor Statistics, Washington, D. C
 Cummings, Dr. Helen F, Research Assistant, Boston Public Schools, Department of Educational Investigation and Measurement, Boston, Massachusetts
 Cushman, Edward L., Research Economist, Michigan Unemployment Compensation Commission, Detroit, Michigan
 DeWolf, Tensard, Director, Bureau of Research and Information, Pennsylvania Department of Labor and Industry, Harrisburg, Pennsylvania
 Eshleman, Benjamin Franklin, State Statistician, Works Progress Administration of Louisiana, New Orleans, Louisiana
 Evans, Wilmoth D., Associate Economist, U. S. Bureau of Labor Statistics, Washington, D.C.
 Filho, Dr. Lincoln de Freitas, Assistant, Div. Biostatistic-National Dept. Health, 128, R. do Resende, Rio de Janeiro, Brazil, South America
 Frankenstein, Katharine D., Research Librarian, Batten, Barton, Durstine and Osborn, Incorporated, New York City
 Fraser, Alfred A., 3rd, Investment Department, United States Trust Company of New York, New York City
 Gore, James L., Senior Statistician, Tennessee Unemployment Compensation Division, Nashville, Tennessee
 Greenman, William B., Jr., Manager, Research Department, Van Cleef and Jordan, New York City
 Hamilton, Eugene L., Director for Area 8, Division of Research, Statistics, and Records, Survey of Works Program Employment Histories, Dallas, Texas
 Hayes, Josef J., Statistician, Department of Public Welfare, Garden City, Nassau County, New York

- Hayes, Dr. Samuel P , Jr., Sarah Lawrence College, Bronxville, New York
- Herzog, Arthur L., Manager of Statistical Department, Chicago City Bank and Trust Company, Chicago, Illinois
- Holmes, Irvin, Agricultural Statistician, U. S. Department of Agriculture, Washington, D. C.
- Hooper, Wallace D , Regional Statistician, Works Progress Administration, Chicago, Illinois
- Lerner, Abba P., Assistant Lecturer, London School of Economics, c/o Rockefeller Foundation, New York City
- Levenson, Hollis M., Psychologist, Boston State Hospital, Dorchester Center, Boston, Massachusetts
- Lilhedale, Juanita, Statistical Clerk, Bureau of Home Economics, Department of Agriculture, Washington, D C
- Murray, Merrill G , Assistant Director in Charge of Analysis Division, Bureau of Old-Age Insurance, Social Security Board, Washington, D C.
- Padgett, Mildred, Assistant Economist, Consumers' Counsel Division, Department of Agriculture, Washington, D. C
- Phillips, Donald, Fellow, College of the City of New York, New York City
- Roeder, Edward M , State Statistician, Works Progress Administration, Nashville, Tennessee
- Sells, Dr Saul B., Senior Research Analyst, Works Progress Administration for the City of New York, New York City
- Stewart, John R , Statistician, Detroit Board of Commerce, Detroit, Michigan
- Wallis, Rolland S , Director of Research and Statistics, Division of Unemployment Compensation and Employment Service, Department of Labor and Industry, Harrisburg, Pennsylvania
- Woolsey, Theodore D., Junior Statistician, Vital Statistics Division, State Department of Health, Albany, New York

BOOK REVIEWS

RALPH J. WATKINS
Review Editor

The Theory and Measurement of Demand, by Henry Schultz. Chicago: The University of Chicago Press. Social Science Studies Directed by the Social Science Research Committee of the University of Chicago, Number XXXVI. 1938. xxxi, 817 pp. \$7.50.

Ten years' research by a distinguished author and a staff of able assistants presented in this very substantial volume cannot but command respect. A synthesis of theory with empirical studies, of the kind so necessary for the development of economics as a science, is accomplished beautifully. The theoretical chapters present basic considerations found in general treatises on economics but present them more accurately and explicitly with the help of mathematical methods. The factual chapters are concerned with the demand functions, as ascertained from time series, of a list of agricultural commodities.

A chapter each is devoted to sugar, corn, cotton, hay, wheat, potatoes, oats, barley, rye, and buckwheat. Each of these chapters begins with a general survey of the production and consumption of the commodity in question and of the relevant statistical data. Demand functions calculated by least squares from time series, with time as an additional variate to take account of trends and guard against spurious correlations, are then presented in each case. These are calculated separately with price and with quantity as dependent variates; and in each instance both constant-elasticity and linear demand curves are fitted. Deflated prices, and quantities divided by population (or animal population units in the case of crops fed chiefly to horses, mules, cattle, and hogs) are used in each case, and in addition some regression equations are fitted without these preliminary adjustments of the variates and in various other ways. This would make a large job of least-square calculation, but the actual work of the kind is several times as great as this suggests; for the time series are broken into two, three, or four parts, with separate computations of all four regression functions for all the different periods, and a comparison of the independent results thus obtained. Additional calculations take account of such factors as national income and general business conditions. For all this, not only are standard errors computed, but exact tests of significance are applied in the places in which they are most important. This step, unfortunately lacking in a good deal of statistical work, is essential in distinguishing underlying forces revealed by the data from chance, and is especially important in economic time series in view of the small number of good observations available in each case and the number of degrees of freedom that have to be used up to take account of trend and other sources of deviation from independence of consecutive ob-

servations. Summaries and conclusions, some of which are novel and have great interest in connection with questions of agricultural and public policy, are given at the end of each of these chapters with respect to the particular commodity, and at the end of the group of chapters for the list of commodities as a whole. It is noteworthy that in every case, without exception, a demand curve of the downward-sloping kind suggested by theory emerges from the calculations. The elasticity of demand for sugar is particularly consistent, taking values in the neighborhood of .3 and .4 in each of the three periods 1875-95, 1896-1914, and 1915-20, as computed by each of the various methods. The differences appear to be of an order reasonably attributable to chance. For the list of commodities in general the elasticities are less than unity, indicating that in each case a large crop is worth less to the farmers than a small one, so that a monopolistic measure of restriction of production could for each commodity be expected to be successful in increasing the income of the producers of that commodity. Whether this could be done for all the farm commodities at once is quite another question, which the author does not discuss. In spite of the justification for crop-control for *any one commodity* indicated by Professor Schultz' statistical findings (from the standpoint, of course, of the producers of that commodity alone), as well as by investigations of L. H. Bean, Mordecai Ezekiel, and others, there is no proof that crop-restriction in general benefits farmers in general, to say nothing of the rest of the population. It is an extremely important point, which does not seem to have been grasped by the authors of the Agricultural Adjustment Act and other crop-restriction measures, that the elasticity of demand for every single commodity may have a numerical value less than unity, so that classical theory would point to a reduction of production as a way to increase income, without the joint cost and demand functions for a long list of commodities having the character necessary for the successful application of crop-reduction in increasing the total of agricultural income. The fallacy lies in the classical habit of considering only one commodity at a time, without regard to their interrelations.

The study of interrelations of demand for different commodities, necessarily complex but yielding beautiful results by the application of higher mathematics, is the subject of careful study in Chapters 18 and 19. This is indeed a field in which mathematics has made distinctive contributions to economic theory in demonstrating the falsity of many classically accepted dogmas, as well as establishing some of the old propositions and many new ones on a substantial basis. Not only quantitative but qualitative features of the economic system have in this way been found to have quite a different nature from that attributed to them by literary economists. An important part of modern mathematical economics is set forth in these chapters and in the introductory ones. A beginner may indeed very well be referred to Chapters 1, 18, and 19 for a conspectus of elementary mathematical economics and a study of some fundamental concepts. Among other things Chapter 1 includes an account of the important paper by the Russian economist

and statistician, Eugen Slutsky, published in Italian in the *Giornali degli Economisti* in 1915, and unfortunately overlooked until very recently.

The other chapters, in addition to theoretical discussions of completing and competing goods, present the results of statistical determinations of simultaneous demand functions for several groups of commodities. These groups are (1) beef and pork, (2) sugar, tea, and coffee, (3) barley, corn, hay, and oats, (4) beef, pork, and mutton. Studies of this type are absolutely essential to forecasts of the probable effects of bounties, excise taxes, crop-control programs, tariffs, and other such measures. In the absence of such quantitative determinations of the appropriate coefficients, and of their proper use in the mathematical investigation of the prospective effects of the proposed measures, it is perfectly possible that governmental measures may have effects directly opposite to those sought by their authors. (For proof of this statement, see my article in the *Journal of Political Economy* for October, 1932.) To get any clear idea even regarding such a simple question as whether the farmers producing a single commodity (for example, corn) are helped or injured by a bounty of so much per unit on that commodity requires studies like those of Professor Schultz for a group of related commodities, not only for demand but for supply. The relations among the commodities vitiate completely the classical reasoning about the division of excise taxes and bounties between producers and consumers.

There is a good discussion of various definitions of competing vs. completing goods. The best of these, at least with respect to a single consumer, seems to have been reached independently by Professor Schultz and by J. R. Hicks very recently. It is given on p. 622 and is based on one of Slutsky's results. The question of the *symmetry* of the multiple demand functions is discussed both theoretically and statistically.

The author draws his inspiration from many sources but chiefly from the pioneering work of Henry L. Moore, to whom the book is dedicated. Moore's methods are used, with modifications indicated by the progress of statistical theory in recent years and by experience. The methods of deriving demand curves used by Leontief, Pigou, Frisch, Marschak, and Roy are discussed critically. Though confining his own statistical studies to time series, the author does not reject the possibility that the derivation of demand functions from family budget data may in the future give results of importance.

Those who doubt the value of conclusions drawn from time series may well point out the difficulties and statistical fallacies with which such studies are beset. The sources of these fallacies seem to have been eliminated from Professor Schultz' work as nearly as it is possible to do this without a great and impractical extension of an already immense labor. It remains true, of course, that the results of time-series analysis can never have the type of validity inherent in randomized allocation of treatments such as is described in R. A. Fisher's recent book, *The Design of Experiments*. But economic statistics would be in a sad plight indeed if this consideration were enough to cancel the force of inferences drawn from time series. When significant results

are reached, such as many of those reported in this book, we accept them, tentatively of course, so long as we cannot find any basis for explaining them away. The author has been very careful in guarding against spurious correlations due to trend and similar fallacies.

An appendix giving the original series used will be a valuable help when extending or checking the work is undertaken. Another appendix is a 52-page treatise on the elements of curve-fitting and correlation and will be useful to many students for its own sake. The whole book is exceptionally well documented. It presents both sides of various controversial questions without, however, failing to reach definite conclusions.

Columbia University

HAROLD HOTELLING

Les Variations du mouvement saisonnier dans l'Industrie de la Construction, Etude méthodologique et analyse des faits, by Horst Mendershausen. Geneva: Georg & Cie. S. A. Libraires/Editeurs. Librairie de l'Université. 1937. 209 pp. 6 Swiss francs.

This highly illuminating volume is more comprehensive than its title implies. Its outstanding characteristic, in the opinion of this reviewer, is its careful adaptation of methods of correlation analysis to a study of the differences from year to year in the month-to-month variations in time series. Construction employment data form the basis of the detailed analysis illustrating these methods, but the methods themselves are equally applicable to the general problem of measurement of variations in seasonality.

Few problems of elementary statistical methodology have been the occasion of more discussion than the proper method of calculating indexes of seasonal variation. The methods most widely used either assume perfect seasonal regularity for all practical purposes or, by simple methods such as the calculation of a gradually changing series of indexes, attempt to allow for the differences from year to year. Mendershausen advocates the measurement of changes in seasonal variation in terms of logically related causal factors.

The volume contains two chapters, several statistical appendices, and a detailed bibliography. Chapter I includes a brief but comprehensive summary of the methods of calculation of indexes of seasonal variation most widely used at the present time; a more intensive review of the methods which recognize changing seasonal variation; a summary statement of the different types of seasonal fluctuations; and an outline of the procedures which are proposed for the analysis and measurement of these fluctuations.

In Chapter II Mendershausen gives a detailed account of the analysis which he has made of the seasonal variation in employment data for the construction industry in five European countries: the United Kingdom, Belgium, Poland, Denmark, and Germany. The analysis involves a careful inventory of the factors which influence seasonal fluctuations in construction employment and the calculation of regression equations in terms of the year-

to-year differences in seasonality as a dependent variable and meteorological changes and changes in the cyclical level of activity as the principal independent variables.

The bibliography is divided into four parts. (1) mathematical statistics and correlation analysis, (2) methods of measurement and elimination of seasonal variation from time series, (3) seasonal variation in the construction industry from the economic and social point of view, and (4) seasonal variation in the construction industry from the point of view of technical methods of construction.

Although the method which Mendershausen advocates is more appropriate for many purposes than a constant index, caution regarding its use will occur to many readers. For the purpose of isolating the fluctuations in time series arising from purely seasonal factors which vary appreciably from year to year, this method has much to commend it. It may be questioned, however, whether unusual fluctuations of a seasonal nature can or should be completely separated from cyclical and other fluctuations, and whether it is correct to assume that each has an independent effect and that the total movement can be expressed as the simple aggregate of all the independent effects. For example, two or three severe winter months or a period of unusual drought or of heavy rainfall may influence not only the values for a given series at that particular time but may have a substantial effect upon the longer time trend. The complete elimination of seasonal influences thus may tend to yield a somewhat artificial residual series. Briefly, this method is likely to prove most useful in determining the causes of seasonal fluctuations but is much less suitable for the purpose of adjusting series to eliminate seasonal fluctuations.

Correlation analysis also is an expensive procedure particularly if multiple calculations are required and if an attempt is made to test for the significance of particular regression coefficients in terms of their probability of chance occurrence. The technique is inviting to research workers, but not all will have the resources necessary to carry it out. Nevertheless, in many instances, particularly in the special study of the causes of seasonal fluctuations themselves, the correlation method of measuring these fluctuations in terms of logically related factors may prove very useful and may fully merit the necessary expenditures.

The present situation in the development of these methods is neatly phrased by the author:

"Le problème lui-même n'est pas entièrement nouveau; mais la plupart de ceux qui l'ont reconnu n'ont pas encore entrepris les recherches nécessaires à sa solution; et ceux qui se sont engagés sur cette voie ne sont pas encore parvenus très loin."

Mendershausen, however, advances the argument to such a point that the measurement of variations in seasonality in terms of related influences no longer can be ignored by careful investigators. LOWELL J. CHAWNER

Washington, D. C.

Growth of American Manufacturing Areas, by Glenn E. McLaughlin. Pittsburgh: Bureau of Business Research, University of Pittsburgh. 1938. Bureau of Business Research Monograph Number 7. xxvii, 358 pp. \$3.00.

Dr. McLaughlin has done an important and useful task in extending back to 1869 the federal census figures for industrial areas, by retabulating census data and making some estimates from other sources. His purpose is a detailed comparison of the industrial development of the several areas, with special emphasis on the relative position of Pittsburgh.

Three measures of industrial growth are used: population, manufacturing wage earners, and value added by manufacture. The numbers *gainfully employed* can be only roughly estimated for years prior to 1930, because the proportion of population gainfully employed has wide regional variations, and also because it displayed a general rising trend before 1910.

Whatever measure is used, a retardation of growth in individual industrial areas appears characteristic as they approach "maturity." The familiar quasi-logistic growth curve appears again and again in Dr. McLaughlin's charts, and he usually has a satisfactory explanation for each upward surge.

One must of course view the implied law of industrial growth with some reservations. A supposedly "mature" area can be rejuvenated repeatedly by new technical developments, discovery of new resources, etc. Forecasts of continued slackening of growth in old areas are accordingly risky. But Dr. McLaughlin puts forward several arguments to show that the development of new industries—a major source of rapid regional growth—is more likely to flourish in relatively undeveloped areas. This applies particularly when the new industry is not imperatively localized by orientation to a concentrated market or to the source of a material, and when such factors as the relative conservatism of business leaders in the older areas can thus play a large part in throwing innovations to more virgin soil.

By means of an "index of instability" the author discovers that deviations from constant rate of growth are systematically greater in those industrial areas dominated by producers' goods and durable goods. This affords corroboration, then, of the thesis he advanced some years ago,¹ namely, that local specialization in durable-goods production, rather than specialization *per se*, is associated with large cyclical variations in employment.

The author elaborately analyzes the data for industrial areas, states, and cities, making feasible for the first time a real quantitative approach to the question of comparative regional growth rates and localization. The Pittsburgh area is given special attention throughout. His ratio-scale charts are so appropriate and effective that one wonders at the intrusion of some sets of relatives to the base 1899, charted on an arithmetic scale.

There is one serious statistical misstep in the book. On page 40, Dr. McLaughlin notes that, "surprisingly enough," over the period 1870–1930 the average rate of population growth for 25 "industrial or manufacturing"

¹ "Industrial Diversification in American Cities," in *Quarterly Journal of Economics*, Vol 45, No 1 (November, 1930), pp 131–149

states was considerably less than that for 23 "non-industrial" states. This classification of the states recurs from time to time in subsequent chapters. He has selected his "industrial" states, however, on the basis of *absolute* numbers of wage earners and *absolute* amounts of value added by manufacture; which leads to a rather peculiar list (p. 42). Texas, Iowa, Minnesota, Alabama, and Tennessee are thus classed as "industrial," while New Hampshire, Delaware, Maine, Vermont, and Oregon are "non-industrial." On the basis of the ratio of manufacturing wage earners to population, which might be a reasonable measure of degree of industrialization, I find the two groups of states above shifted to the opposite categories. Texas, for instance, ranks 15th in number of manufacturing wage earners (as of 1929), but only 43rd in ratio of wage earners to population; while New Hampshire ranks 29th in wage earners but 3rd in ratio of wage earners to population.

In a long chapter on "Reasons for Regional Differences in the Rate of Industrial Growth," the various locational factors accounting for the observed trends are set forth with clarity and some detail. This is a real contribution to our understanding of American economic geography, and merits the theorist's attention at several points.

Dr. McLaughlin measures the "suburban movement of manufacturing," but here the results are of less significance than they might be. He finds a general tendency for the central city of an industrial area to diminish in importance relative to the surrounding portion, and is careful to state that the data for cities are "adjusted wherever necessary for changes in city boundaries." But it is certainly not surprising that as an industrial community grows it should also spread, and spill out increasingly beyond any fixed limit area. Simply because the percentage of rate of industrial growth is more rapid in the suburban zone, we can by no means conclude that industry is becoming more suburban. Industry spreads to the suburbs, but at the same time the suburbs are becoming more fully urban. We must then look elsewhere for information as to whether the net result is a greater or a smaller degree of agglomeration.²

In his two final chapters the author considers the Pittsburgh district—first by its individual counties, and then as a unit in relation to rival districts. A fact partly responsible for this study, perhaps, is that the district has been showing the marked retardation of growth characteristic of "industrial maturity." In the decade 1920–30 there was a net emigration of population.

For the Pittsburgh district as a whole, its chief resources (coal, waterways, and gas) are seen as the basis for continued slow growth along present lines of specialization. In steel production, according to Dr. McLaughlin, the Chicago district has only the temporary advantage of more modern equipment. His forecast is that the Pittsburgh district will remain a cyclically-sensitive coal and steel district, and must face the long-run handicaps of

² Incidentally, it seems surprising that Dr. McLaughlin ignores several previous statistical studies of industrial and human migration, notably Daniel B. Creamer's *Is Industry Decentralizing?* (Philadelphia: University of Pennsylvania Press, 1935); later incorporated in the final report of the Study of Population Redistribution, entitled *Migration and Economic Opportunity* (1937).

competition from newer coalfields, increased economy in the use of coal by industry, and the growing substitution of scrap steel for pig iron. The aluminum, electrical-equipment, and glass industries are growing more rapidly, but have only a minor influence on the growth trend of the area. If retardation of growth is not to continue, there must be a steady infusion of additional new industries.

EDGAR M. HOOVER, JR.

University of Michigan

Tables of the Ordinates and Probability Integral of the Distribution of the Correlation Coefficient in Small Samples, by F. N. David. London: Issued by the *Biometrika* Office, University College, and printed at the University Press, Cambridge, England. 1938. xxxviii, 55 pp.

The title of Miss David's *Biometrika* office monograph will practically suffice as its review. The book is about equally divided between text and tables, the text containing good theoretical discussions of the principles by which the theory of probability may be used as a guide in drawing inferences from observed correlations, plus a liberal sprinkling of examples which demonstrate each use of the tables.

R. A. Fisher in 1915 gave the probability distribution of r in samples of n from a normal population with correlation ρ . By the next year Karl Pearson was already planning the presentation (in *Biometrika*, 1917) of this information in tables of ordinates and photographs of models of the r distribution for different n and ρ .

Of course Fisher's logarithmic transformation of r provides an almost normally distributed z , but Pearson, seeking even greater accuracy, asked Miss David in 1931 to prepare the tables of the probability integral here presented.

The tables are given for successive sample sizes from $n=3$ to $n=25$ and then for selected larger samples, $n=50, 100, 200, 400$. Tabular values are presented for each population coefficient ρ at 0.1 intervals from $\rho=0.0$ to $\rho=0.9$, and for each sample coefficient r at 0.05 intervals from $r=-1.00$ to $r=+1.00$. Even smaller intervals of r are taken near $r=+1.00$, for $\rho=0.9$.

Miss David describes in some detail the construction of her tables and the methods of their interpolation; and she indicates their use in solving the following types of problems:

1. Are the observed data in a sample consistent with the hypothesis that in the population,

$$(i) \rho \geq \rho_0, (ii) \rho \leq \rho_0, (iii) \rho = \rho_0$$

where ρ_0 is some specified value?

2. How may the observed data in a sample be used to the best advantage in order to calculate limits ρ_b and ρ_a , such that the statements

$$(i) \rho_b \leq \rho \leq +1, (ii) -1 \leq \rho \leq \rho_a, (iii) \rho_b \leq \rho \leq \rho_a,$$

regarding the unknown value of ρ in the population sampled may be made with given degrees of confidence?

- 3 Suppose we have k ($k \geq 2$) independent randomly drawn samples. Are the observed data consistent with the hypothesis that in the k populations sampled the coefficients of correlation, $\rho_1, \rho_2, \dots, \rho_k$, are all equal to

- (i) a specified value, ρ_0 ,
- (ii) a common but unspecified value, ρ ?

An appendix provides an excellently clear, straightforward derivation of the distribution of the correlation coefficient for any n and ρ , for samples drawn from a normal bivariate population

The charts, giving the results of the tables for selected sample sizes and confidence limits of 0.10, 0.05, 0.02, 0.01, serve the important purpose of providing ready reference to approximate answers.

The reviewer feels that, although Miss David deserves great praise for such a tremendous compilation well done, she has earned even greater acclaim for having restated a portion of R. A. Fisher's work in such a manner as to make it definitely intelligible. Her treatment of the risks of rejecting a true hypothesis along with the risk of accepting a false one is both lucid and stimulating. If, as E. S. Pearson says in an editor's preface, the study of correlation is "not merely toying with an interesting historical relic of the past," Miss David's volume is indeed a valuable contribution.

FRANCIS MCINTYRE

Cowles Commission for Research in Economics,
and Colorado College

Mathematical Tables, Volume VI, Bessel Functions, Part I, Functions of Orders Zero and Unity, Prepared by the Committee for the Calculation of Mathematical Tables, British Association for the Advancement of Science. Cambridge University Press. New York The Macmillan Company. 1937. xx, 288 pp. \$14.

The major part of this volume (170 of the 288 pages) is devoted to the tabulation of the values of the basic Bessel functions $J_0(x)$ and $J_1(x)$ by intervals of .001 from $x=0$ to $x=16$ and by intervals of .01 from $x=16$ to $x=25$. All these values are given to ten places of decimals. Also included are the values from $x=0.00$ to $x=25.00$ of functions $Y_0(x)$ and $Y_1(x)$ which are independent solutions of the Bessel differential equation for the cases $n=0$ and $n=1$, the values from $x=0.000$ to $x=5.000$ of the functions $I_0(x)$ and $I_1(x)$ which are solutions of the differential equation

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - (x^2 + n^2)y = 0$$

for $n=0$ and $n=1$, and the values from $x=0.00$ to $x=5.00$ of functions designated as $K_0(x)$ and $K_1(x)$ which are independent solutions of the same equation, as well as the values of the arguments at the first 150 zeros of $J_0(x)$ and $J_1(x)$ together with the values of the other function for the same argument, and similar tables for the first fifty zeros of $Y_0(x)$ and $Y_1(x)$. In addition to the main tables, there are tables of interpolation coefficients, differences of the tabulated functions, and auxiliary functions useful for purposes of interpolation.

The following features seem worthy of special mention:

- (1) A complete explanation of the methods used in calculating and checking all values.
- (2) A concise summary of the definitions and principal mathematical relationships of the various functions tabulated, including asymptotic series for their calculation.
- (3) A systematic tabulation of the various notations which have been used by different authors in connection with Bessel functions with their equivalents in terms of the notation of the present volume.
- (4) Complete tables of all the values needed for interpolation in any range including values of the coefficients in various interpolation formulae. In those ranges where interpolation by the usual formulae is not satisfactory, values of interpolable auxiliary functions are tabulated, with instructions for obtaining from them the corresponding values of the original functions.

All values are given to at least seven decimal places; most of them to eight or ten. The arrangement of the tables is excellent, the printing is unusually clear, and the precautions taken to insure accuracy would seem to justify the belief of the compilers that the tables are "completely free from error." After a most careful examination of the book I can find nothing to criticize, and it is certain that this volume will be a boon to all who have frequent need of values of Bessel functions.

T. N. E. GREVILLE

University of Michigan

Primary Mental Abilities, by L. L. Thurstone. Chicago, Illinois: The University of Chicago Press. Psychometric Monographs, Number 1. Published for the Psychometric Society. 1938. ix, 121 pp. \$2.00.

We have, in this study, an illustration of the practical import or working out upon quite extensive data of the author's techniques and point of view, as earlier given in his "Vectors of Mind" and collateral studies.

The author was able to administer 56 tests to a group of 218 students of a slightly superior college level of ability. These were then analyzed by the author's centroid method and axes rotated in line with his "simple configuration" concept to yield final vectors, or mental factors.

It is corroborative of earlier analyses made by the author and others,

even though reliability coefficients or standard errors of vector constants are lacking, that four nearly independent vectors, a Spatial factor, a Numerical factor, a Verbal relations factor, and a Memory factor, are dimensions which can be used in the analysis of the mental ability of students at this level. The author does not report the correlation between factors, but these may be estimated from his Table 4.

The author finds a Perceptual factor fully entitled to rank with these four in importance, and a number of smaller factors, two of which, Word Fluency and Inductive Reasoning, are, in his judgment, trustworthy. In view of the lack throughout of probability tests of significance, the reviewer cannot share the author's confidence in all these factors, but he does consider the existence of a Perceptual factor highly presumptive and worthy of serious consideration. One argument that this factor is a discovery is that it is not so obviously dictated, as were the Spatial, Numerical, Verbal, and Memory factors, by employing in the initial test battery many tests heavily loaded with it. Unfortunately its substantial correlation with the Spatial factor militates against its usefulness.

Though the finding of the four-mentioned factors can hardly be called a discovery, as the initial tests were so chosen as to be heavily loaded with them and the "simple structure" procedure of the author necessitates that they be rediscovered in the factors, provided only that the mental operations, simple or complex, represented by the tests exist and can be fairly reliably measured, nevertheless the relative independence between them is an experimental finding. This independence could not be there unless it was first in the psychic structures of the individuals tested.

Comment as to certain techniques is in order. The author provides an empirical function, on page 66, for determining the number of significant factors to be extracted. No standard error is provided for this function, and it takes no account of whether factors are correlated or independent, an item which the reviewer would believe to be inherently pertinent, but since it is admittedly empirical it must be left to the test of usage.

To those who anticipated working with Dr. Thurstone's extensive test data and checking and reworking analyses, the greatest disappointment is probably in the fact that tetrachoric correlations were used throughout. Dr. Thurstone has followed this procedure not only to economize time, which should hardly have been necessary as only 1540 correlation coefficients are involved, but also to normalize his distributions. This intent seems most commendable. Dr. Thurstone notes that the distribution of raw scores is essentially arbitrary, and any skewness found therein cannot be taken as reflecting a skewness in the distribution of talent. "Hence," he states, "in using tetrachoric coefficients, we are estimating the product-moment coefficient for the normalized distributions of scores." This seems plainly to be a serious error. It is a simple matter to construct two correlated skew distributions, normalize each, calculate the product-moment correlation coefficient from these normalized scores, and observe that this coefficient

differs materially from the tetrachoric correlation coefficient. For tetrachoric r to equal product-moment r , not only is normality of marginal totals necessary but also linearity of regression and homoscedasticity of arrays. Neglecting these last two conditions leads to consequences which are, or at least may be, quite disastrous. The tetrachoric correlation matrix may contain impossible or inconsistent values, and any attempt to factor and then apply sampling theory and determine standard errors of constants derived is undermined at the start, for all theory so far developed, including Dr. Thurstone's, assumes consistent product-moment correlation coefficients. That so fine a body of original test scores cannot be used in this manner is an occasion for, shall we say, psychometric sorrow.

The reviewer, upon a second reading of the sections dealing with the nature of the population sampled, has been unable to find any statement as to the sex distribution of the subjects tested. If all the subjects are of one sex, this is just an unhappy oversight upon the part of the author, but if they are of both sexes it is more serious, for sex is itself a vector of first importance which should be "partialled out" before further analysis is attempted. [The reviewer admits that he himself has been derelict upon this very point.]

The cleverness which has been shown in the construction, adaptation, and selection of tests, and in securing rapport of subjects, leads the reviewer to express the hope that the author will still make available product-moment correlation coefficients for all the variables used, and for sex and age in addition. Though the reviewer believes there is much of suggestion and even permanent value in this study, nevertheless the demonstrable value of a study in a moot field lies in its fortification of crucial statistics with distributions or at least standard errors and in the amenability of its basic data to verificatory examination by others using sound and, if possible, different methods.

The psychologist concerned with the practical problems of guidance, as well as the psychometrist concerned with the general problem of mental analysis, will find this study rich in suggestion.

TRUMAN L. KELLEY

Harvard University

Narrenspiegel der Statistik. Die Umrisse eines statistischen Weltbildes, by Ernst Wagemann. Hamburg: Hanseatische Verlagsanstalt. 1935. viii, 255 pp. RM 7.50.

What statistician has not been told that anything can be proved by statistics, and that there are "liars, damn liars, and statisticians?" The author of this book, professor at the University of Berlin, chief of the Institute of Economic Research, and formerly head of the German Central Bureau of Statistics, heard these remarks once too often. Moved by a holy

indignation, the inspiration came to him to write something that would form an answer to the constant "defamatory statements about a science which is fundamental to political and economic administration." Only one method seemed suitable for this purpose, namely to expose the existence of a strict system of statistical sins—counterfeit concepts, contradictions in analysis, and erroneous conclusions drawn from statistical data. The result was this book, a "Fool's Mirror of Statistics" which, according to the wrapper, "shows how it pleases an honest Public to poke fun at Statistics and how even an honest Purpose often misses its Goal and in which, to the deterrence of Statistical Sins and to the Relief of all Good People there is shown that although Deceit and Wilfulness can prove anything by Statistics, everything turns out for the best in the End."

This quotation should not mislead the reader into believing that here is an essay of inconsequential nature. On the contrary, the book is a brief treatise on the theory of statistics. It gives in systematic form a discussion of statistical groups as expressions of logical concepts; it deals with the problems involved in securing data, it treats at length the questions of correlation and sampling techniques, index numbers, statistical prognosis, etc.; in short, all the fundamental aspects of statistics are covered. Throughout the presentation the author points to possible sources of errors and, from his rich experience and wide knowledge of the sources and literature of economic and vital statistics, he draws ample illustrations of bad as well as good statistical procedures. The style is lively, punctuated by humor and at times rising to poetical heights not ordinarily scaled by writers of statistical works. All in all, the book is an excellent introduction to statistics and should be required reading for all students. The seasoned statistician would derive both pleasure and profit from it. It deserves to be translated.

THORSTEN SELLIN

University of Pennsylvania

Duodecimal Arithmetic, by George S. Terry. New York and London: Longmans, Green and Company. 1938. 407 pp. \$7.50.

Some college algebra textbooks treat briefly of other systems of notation than the decimal and mention the advantages which would have arisen if primitive man had had six fingers on each hand and thus had been led to develop a duodecimal system. It has remained for Mr. Terry to do a really thoroughgoing job in this field. In a quarto volume of 407 pages (or 29*E* in his notation, where *E*¹ represents "el" or 11, and the whole is equivalent to $2 \times 144 + 9 \times 12 + 11 = 407$ in decimal notation) he presents a multiplication table (an addition table would have been useful also), conversion tables, tables of factors, powers, roots, and reciprocals, and a number of other tables for common needs. More than three-quarters of the book is taken

¹ Actually in Mr. Terry's facsimile-typewriting book, the figure 3 upside down is used for "el." A capital *X* is used for "dec" or 10, while 10 represents "do" or 12. Ready distinction between the two systems is attained by printing decimal figures in the ordinary form and duodecimal ones in italics.

up with tables of the natural and logarithmic trigonometric functions to nine duodecimal places, for arguments to four-place duodecimal fractions of the whole circumference, which is taken as the angular unit; and with tables of the nine-duodecimal-place logarithms of numbers from 1 to *EEEE* (1 to 20,735 in decimal notation). In addition there are brief tables of digamma, Bessel, and interpolation functions.

It is an imposing piece of work, and Mr. Terry has rendered a great service to pure mathematics in making it available. He points out in his introduction the considerable simplification of many arithmetical operations which would result from the use of the duodecimal notation; and that machines could readily be made to carry by 12's instead of by 10's if there were a demand for them. The reviewer tried a number of arithmetical examples by both systems, and, with no preliminary practice and without learning the new multiplication table, took less than three times as long with the duodecimal as with the decimal notation. Undoubtedly practice would soon bring proficiency.

The book might well be used in high-school and college classes to provide supplementary work for brighter students. In time, this would produce a generation of mathematicians to whom the notation was familiar and who might find it useful for certain work. Whether the system can ever be more widely adopted seems doubtful, in view of the resistance met by much less fundamental reforms such as the metric system or the World Calendar.

DICKSON H. LEAVENS

Cowles Commission for Research in Economics

An Introduction to Business Statistics, by John R. Stockton. Boston: D. C. Heath and Company. 1938. v, 378 pp. \$3.00.

Laboratory Manual for Business Statistics, 1938-1939 Series, by John R. Stockton. Austin, Texas: Hemphill's Book Store. 1938. v, 97 pp.

This text and accompanying laboratory manual are additions to the rapidly growing "Introduction to Statistics" family, which necessitates considerable care to determine wherein the additions differ from the older members.

The author says of his text: "This book is not designed to train statisticians but to familiarize students—with the most common statistical methods—and to make them conscious of the importance of statistical data and its analysis in the management of business enterprise." To attain these objectives he "covers the topics usually considered in a first course in business statistics," he places emphasis "on the way in which the different statistical techniques are actually employed in business," and he includes 47 short problems in the text and 30 longer problems in the manual "to give students practice in computing the different statistical measures, and experience in using data and analyses in the forming of business judgments."

Some 80 pages are devoted to introduction, to secondary sources (Business

Barometers), to collection, and to classification and tabulation. In the reviewer's opinion the chapter on Business Barometers should appear within the first rather than within the last 50 pages.

The 35 pages devoted to tabular and to graphic analysis satisfactorily present the fundamentals of these topics. But the reviewer feels that the sections dealing with the graphic analysis of the time series and perhaps those concerned with correlation charts should be included in the chapter on charting.

The numerical analyses (averages, dispersion, and correlation) require some 80 pages. To "familiarize students with the most common statistical methods" this general section should have included chapters on ratios and on the unreliability of statistical numbers, for the former is commonly used (and abused), and the latter is essential to a complete understanding of the numerical measures.

The analysis of the time series (some 115 pages) is very well done. The forces affecting this series are discussed. The numerical analysis is elementary and emphasizes the meaning of and the uses of such derived numbers.

The discussion of the construction of index numbers of business activity is presented within 15 pages. The reviewer has long felt the need of including such a discussion in an elementary text. But he wishes the chapter had shown the relationship in construction between a business activity index and a price index more clearly, since the problems in the text and in the manual are concerned with the latter.

The 47 short problems, appearing as an appendix, are excellent. They should prove to be interesting, for the data are drawn from many sources, and many of the questions are so stated that the student must use his judgment in answering.

Of the workbook, which includes the necessary tabular and graphic blank forms, the author says he "deliberately introduces somewhat complicated situations in which the figures do not always 'come out even' and in which the analysis of the data and the conclusions may be somewhat bewildering." The problems, however, "attempt to present realistic situations, the solution of which requires real data." Lastly, the forms are not complete in every detail, "for the setting up of columns with their proper captions is an important part of the working problem."

The 10 problems dealing with the numerical analyses and the 13 with the time series are not likely to be found too complex for the beginning student. Several of the problems may be shortened by omitting the parts involving repetition of procedure. The problems concerned with index numbers and with correlation are least satisfactory, the former because only four commodities and four years are involved and the latter because only simple linear correlation of ungrouped data are analyzed. Since formulas or unique symbols are omitted, the workbook may be used with any introductory text.

In summary of both text and manual, the reviewer noted on the one hand that the text lacked organization in part (which is a matter of opinion),

that it was incomplete in part, and that it was distinctly elementary (which is not a fault); and, on the other hand, that stress was placed upon the meaning of and the uses of statistical numbers and that the problems were excellent. He drew the conclusion that the text had several shortcomings. The volumes have their place, however, in the family of which they are members.

CLAUSIN D. HADLEY

Indiana University

Nassau Senior and Classical Economics, by Marian Bowley. London: George Allen & Unwin, Ltd. 1937. 358 pp. 15 s.

This doctoral dissertation from the London School of Economics is of remarkably high quality—actually unique in the field of history of doctrine (in the reviewer's judgment) for the combination of scholarly breadth and accuracy with analytical insight. The six chapters of Part I, on "Economic Theory," fill three-quarters of the text and present a rounded treatise on the thought of the Classical School, with Senior as a point of orientation, together with immediate background and the main French and German writings in the same tradition. Part II (pp. 237–339) deals more explicitly with Senior, under the two heads of governmental policy and the poor law problem. This section, although dealing with matters of perhaps equal importance, gives somewhat the impression of a let-down, partly because of the nature of the subject matter and partly because the first of the two chapters is in some measure a repetition of the first chapter of Part I, on "Scope and Method," and this is the weakest of the chapters on theory.

The main limitations of the work, as regards appeal to a wide circle of readers and use in university courses, seem to be, first, that it presupposes a very great deal, both in knowledge of the literature of economic theory and in grasp of its problems. It is not a book for elementary students. In the second place, the author leaves her own position unstated, with the result that the reader finds it difficult or impossible to tell what is her conception of advance in the field, or the nature or magnitude of Senior's "contribution." This is not necessarily a defect, since the alternative is nearly certain to be writing the history of doctrine in terms of the writer's own doctrine as the goal of progress; but the consequences of either procedure must be recognized and accepted. The historical approach to any division of intellectual or cultural history is sharply different from that of the special student in the field itself.

The book shows numerous examples of carelessness in final revision and proofreading, especially in the earlier parts. For example, on the same page (74) the first sentence contains a superfluous "that," and the first footnote gives the title of Ricardo's main work when that of Adam Smith is obviously meant. The Index gives only proper names and is imperfect (note fusion of the elder and younger Keynes under the name of the latter, usage in the

book being correct), whereas indexing of subjects would be highly valuable. As Professor Viner has pointed out (*Economic Journal*, June, 1937), the bibliography of Senior's published and unpublished works (Appendix II) contains errors in detail. None of these criticisms or suggestions seriously modify the judgment that Dr. Bowley has written a book of extraordinary merit.

FRANK H. KNIGHT

The University of Chicago

New Fashions in Wage Theory: Keynes, Robinson, Hicks, Rueff, by Jürgen Kuczynski. London. Lawrence and Wishart. 1937. viii, 99 pp 3/6.

This book is a collection of statistical essays written from the Marxian point of view. In the first part, the wage theories of Rueff, Keynes, and J. R. Hicks are subjected to critical analysis. Mr. Kuczynski easily shows some of the superficialities in Rueff's contention that increases in real wages cause unemployment, while decreases lead to increased employment. He correctly points out that Rueff's index of real wages was erroneous, since it divided money wage rates by the wholesale price index, whereas he should have used an index of actual earnings and one of the cost of living. Rueff, therefore, employed a price index which was more flexible than the facts warranted and an index of wages which was less flexible. Working with more accurate statistics for Germany for the years up to 1932, he finds Rueff's figures disproved until at least the beginning of the great depression.

In dealing with Mr. Keynes' wage theory, he correctly points out that it is based upon a desire to hold money wage rates constant but to increase prices through monetary management, thus decreasing real wages and sending up the return to management in order to overcome the liquidity preference and stimulate investment. This, however, is only true within the business cycle when there is a considerable volume of unemployment. Kuczynski goes on to state that Keynes' lucid interpreter, Mrs. Robinson, wants to preserve a moderate margin of unemployment so that money wages may, indeed, not rise too high, and so that the deflation of real wages and the enhancement of entrepreneurial gains may, in fact, occur.

From these writers, as well as from Mr. Hicks' gloomy views about the dangers of increasing wages, Mr. Kuczynski implies that the nonsocialist wage theorists can offer no hope to the workers within the framework of capitalism and that their program for prosperity is merely to cut wages, whether openly or covertly. He, therefore, classes these economists as the witting or unwitting protagonists of Fascism. The conclusion is drawn that only a new and socialized order of society can improve the position of labor.

It is small wonder if Mr. Kuczynski does not recognize that Keynes' wage policy is intended primarily to apply within the business cycle and is not necessarily intended to govern long-time movements of wages. It is in terms of the long run (at least up until 1929) that capitalism has given great gains to labor. What Kuczynski and some of those whom he criticizes

neglect is that wages may increase through time, and in the past have done so, because of increased marginal productivity. This, in turn, has been caused by: (1) a growth in the rate of capital which has exceeded the relative increase of labor, and (2) by technological advance as well. These factors are surely more important in the long run as determinants of wages than the rather strained short-time explanations which are advanced by those who are obsessed with the all-importance of monetary policy.

Despite Mr. Kuczynski's keen analysis of the statistical inadequacies of the wage theories of other writers, he lets his own zeal get the better of him when it comes to his essay on "Wage Averages Within a Capitalist Organism." By lumping together the British and Indian textile industries, he comes to the conclusion that real wages have decreased; and the Marxian contention that the condition of the workers undergoes progressive deterioration from one major trade cycle to another is confirmed. If, however, he had taken the statistics for all workers within Sweden, Great Britain, and the United States as computed by Bagge and his associates, by Bowley, and by the present reviewer respectively, he would have found a long-time and fairly steady increase in real wages.

PAUL H. DOUGLAS

University of Chicago

Introduction à l'Economie Dirigée en sept leçons, by Dan Radulescu. Paris: Librairie des Sciences Politiques et Sociales, Marcel Rivière. 1937. 128 pp. 18 fr.

The title is misleading and the book a complete disappointment. Devoid of thorough analysis and failing to transmit an appreciation of the complexities of the problems involved, this book is milk and water even for high-school juniors. Still worse, it is a storehouse of error, misinformation, and prejudice against economists, bankers, and financiers alike. Over half of the book deals with introductory descriptions of the rudimentary features of capitalism, and the author, a professor in the University of Cluj, skips in sprightly style from topic to topic, mentioning a theory here, citing a fact there, seeing flaws everywhere and smartly charging them to the stupidity of economists or the cupidity of bankers. In the remainder of the book Professor Radulescu offers a brief outline of his favorite schemes, moving with naive ease from quarter to quarter of his blueprint, lightly brushing away all difficulties, and applauding his own propositions with the praise that they are "simple, logical and lucid," adjectives which recur with monotonous frequency throughout the book.

Let the work, through a few examples, speak for itself. Supply and demand, the author claims, express only a "statistical rule," but are "pompously called a fundamental law" by economists (p. 19). Monopoly "is the exclusive right to exploit a given economic field which the state reserves for itself or confers upon a particular institution" (p. 23). The price of a good is "only a conventional and arbitrary relationship established between ob-

jects" (p. 28). The quantity theory of money is one of "the most amusing and most fallacious theories." It equates the value of money to P/N , where P is "the sum of the prices of all objects expressed in gold" and N is "the amount of money issued." This theory is "crudely false" because it neglects credit (pp. 33-35). "According to the conception of Ford as well as modern sociologists," the function of industry and commerce is to render service to society (p. 81). Nothing should be imported by a country except what cannot be produced within it (p. 84). Tourist expenditures abroad occasion "considerable loss" to the home country inasmuch as it will be obliged to pay for their expenditures with exports "without receiving anything in exchange" (p. 99). The list can be extended, and the pages dealing with a planned economy are scarcely informed with greater competence.

M. M. BOBER

Lawrence College

Entwicklung und Strukturwandlungen des englischen Aussenhandels von 1700 bis zur Gegenwart, by Werner Schlote. Jena, Germany. Verlag von Gustav Fischer. 1938. Probleme der Weltwirtschaft, Schriften des Instituts für Weltwirtschaft an der Universität Kiel. Herausgegeben von Andreas Predohl. Vol. 62. viii, 182 pp. RM 10.—(in paper cover).

For many years the Kiel Institute of World Economics has enjoyed a high reputation for its scholarly, realistic contributions to the science of international economics; today one has reason perhaps to add: contributions to the international science of economics. Together with a complementary new publication by the Institute (*Wachstum und Wachstumsformen der englischen Industriewirtschaft*, by Dr. Walther Hoffmann), the present volume will certainly prove that the Kiel Institute continues to be one of the most important centers of economic research the world over. Granting that some of the results of a very considerable amount of patient statistical work might still be improved, granting furthermore that a thoroughgoing economic and historical analysis of the material presented has yet to be made, this reviewer wants to emphasize that Dr. Schlote's study fills an important gap in our literature and will prove not only helpful but indispensable in further research. As a contribution to a comprehensive long-period analysis of English capitalism, the book presents and describes with great skill very long series of statistical data concerning English exports, imports, and re-exports. These data are sufficiently differentiated as to commodity groups and to the direction of foreign trade, the latter with special regard to trade relations within the Empire. The earlier parts of these series are, of course, not completely reliable. Taken merely as indicating orders of magnitudes, however, even these figures are of great help in any quantitative trend analysis.

The book opens up with a "methodical section" which describes first the nature of the statistical material and then the methods applied to overcome

serious difficulties and to connect various segmental series into long continuous series. Aside from changes in the extent of the British territory, the most important difficulty is created by the curious fact that English exports from 1696 until 1798 and imports and re-exports from 1696 until 1853 were evaluated only on the basis of "official" prices; most of these, however, were prices actually prevailing in 1694 and were never revised during the whole period of approximately 100 and 150 years respectively. In his attempt to get at the "real" (actual) values of the various subgroups of imports, etc., for as long a period as possible, Dr. Schlote takes a roundabout way over the computation of trade "volumina," i.e., adding up quantities of different commodities traded in consecutive years by weighting each commodity always with the same price through a more or less long period. The problems involved in this procedure, its merits and limits, are discussed briefly but very clearly. The obvious shortcomings—which are best illustrated by the official English evaluation method just referred to—are greatly reduced by breaking up the whole long period of 1820–1934 into seven subperiods, for each of which the price weights are changed. One might wish an even greater refinement; the possible gain, however, would very probably not warrant the additional labor required. In order to find the actual ("real") values of imports and re-exports at least for the period 1800–1854, the author uses the respective figures for "volumina" and applies to them Jevons' index numbers of wholesale prices. (Consequently, for this period no absolute figures for actual values but only index numbers are produced.) The reliability of this method should be checked sometime by using recorded actual prices for individual commodities, at least for some few test years. Jevons himself, Tooke-Newmarch, and Sir William Beveridge's forthcoming history of English prices would probably provide sufficient data.

The results of Dr. Schlote's statistical research are collected in an appendix of about 70 pages, which also contains a short paragraph on the development of English food tariffs in the nineteenth century. The second chapter of the main text analyzes these data with the help of many graphs and tables which usually reorganize the statistical material in terms of quota or relative shares. This method brings out very well changes in the relative position of the various items but tends somewhat to obscure the fact that a heavy decline in relative shares might still be compatible with an absolute increase in value or volume of a given group of commodities. Occasionally the author himself cautions the reader. Even within the limits of this descriptive study, however, it might have been worth while to emphasize the great significance of the fact that, in contradistinction to the postwar period, all the major readjustments which the English economy had to undergo during the nineteenth century almost never implied any absolute decline of major industries. This fact helps to explain the relative severity of the English postwar structural crisis. One might also criticize that in many tables and diagrams the series break off with depression data and neglect the remarkable revival also of English foreign trade in the last few years. Finally, the present

writer would have welcomed an even more careful use of export-import price ratios. These are very minor points, however, in view of the extremely lucid presentation of all the main developments in English foreign trade. Especially interesting is the correlation of foreign trade series with Dr. Hoffmann's index of industrial production.

The effects of Sir Robert Peel's free trade policy and of the later industrialization of continental Europe and oversea countries are brought out very clearly.

In general the author refrains from any causal analysis which would involve theoretical consideration as to possible relationships and even more from any political evaluation. At every step, however, the reader feels that Dr. Schlote was well aware of all the important problems to whose solution his empirical work might contribute.

GERHARD MEYER

University of Chicago

Business and Modern Society, edited by Malcolm P. McNair and Howard T. Lewis. Cambridge: Harvard University Press. 1938 viii, 411 pp \$5 00.

This is a collection of 14 papers by members of the faculty of the Harvard Graduate School of Business. According to the preface and the pronouncement on the jacket the papers are addressed primarily to business men in their thoughtful and reflective moments and only incidentally to economists in their professional capacities. The topics dealt with range from such very broad and general questions as Dean Donham's essay on "Material Progress and Social Discontent" or Professor Isaac's on "The Logics of Public and Private Administration" to quite specialized and "practical" ("ideas-I-can-use-in-my-own-business") themes such as Professor Walker's paper on "Some Recent Experiments in the Control of Manufacturing Costs" or Professor Roethlisberger's "Understanding: A Prerequisite of Leadership." Moreover, some papers aim to summarize for the business man the results of recent thought and investigation on particular questions, e g, Professor McNair's "Business Cycle Theories. Some Comments for the Layman," while others such as Professor Hubbard's "The United States Federal Debt, with Special Reference to Bank Holdings and Monetary Control," present rather the findings and conclusions of original investigations. All these and Professor Gras' brief summary of "The Historical Background of Modern Price Regulation" make interesting and suggestive reading. As the titles indicate there has been no effort to have the papers revolve around any common theme; and the title of the volume would have been more descriptive of its contents had the phrase "some aspects of" been prefixed to it.

From the point of view of the economist and statistician the papers are of varying degrees of interest. In view of recent studies they will doubtless welcome Professor Hosmer's paper on "The Effect of Direct Charges to Surplus on the Measurement of Income." It is not as generally appreciated

as it should be that the reported net incomes of business corporations are in the nature of a rough guess predicated on certain assumptions with respect to the appropriate methods of valuing durable assets. Professor Hosmer emphasizes that even this figure is open to arbitrary variation within wide limits because of the very loose practices governing the assignment of charges between capital and income. This is no minor matter, in view of the (apparently) great significance attached to reported earnings by investors, business men, governmental agencies, and buyers and sellers in the capital market generally. All manner of important decisions are apt to be made on reported earnings as an aggregate, or as a percentage of past historical investment, as though such figures were precise, accurate, and comparable between years and between corporations. Seemingly intelligent people are willing to "believe in" and act upon reported net income figures at the same time that they disdain to attach much importance to balance sheet statements. Yet it is surely not open to dispute that any error in the one is by the same token an error in the other.

Somewhat similar problems are considered in Professor Sanders' paper on "Proposed Reforms of Accounting," although his main concern is with the recently circularized statements of "accounting principles," the accounting regulations of state and Federal administrative agencies, how these have been interpreted and applied in practice, and the results thereof. Although he finds much to criticize with respect to all these, his points are frequently well taken. In other cases, however, the reviewer doubts very much if equally competent authorities would concur with his strictures (e g , pp. 79, 81, 83-85). Indeed some of Professor Hosmer's remarks in the paper already mentioned appear to be flatly contradictory on certain points of accounting theory. On the whole Professor Sanders seems to be much more certain than his colleague of the basic "soundness" and usefulness of some of the time-honored "principles" of accounting.

Professor Slichter's paper, "The Adjustment to Instability," deals with the highly important question of profit expectations and their determinants. Profit expectations are improved by cost reductions on the assumption that prices and sales volume are maintained or do not fall as much. But this is precisely the dilemma. A cut in wage rates, for instance, may either increase or decrease the total wage bill depending upon the elasticity of demand for labor if we may assume that the demand schedules for products are unaltered. In dealing with one enterprise or one industry such an assumption does not do much violence to the facts. But in treating the whole economy one cannot assume that consumers' outlay will be unchanged with a reduction in wage rates. Slichter makes certain distinctions between immediate and longer-run results and emphasizes the importance of relative rates of change; but he is apparently skeptical of the efficacy of wage-cuts alone. He writes (pp. 253-54): "The point which I wish to emphasize in particular, and which is the essence of my argument, is that neither reductions in cost-determining prices nor support of markets is enough. *In fact, each alone is*

dangerous. Each needs to be supplemented by the other." (Italics in the original.) There are few questions in economics of greater importance than that of the relative merits of wage-rate maintenance or wage-rate cuts as a depression policy. And it is probably not inaccurate to say that among economists there is no consensus as to the proper policy to be followed. Slichter believes wage cuts are an almost indispensable aid to revival, and his reasoning is provocative and sometimes novel; but doubtless he would be the first to admit that he has not said the final word. Parts of the analysis seem a little tenuous; and at one point (pp. 245-46) there appears to be a confusion between funds and flows; but this may be because the full assumptions are not stated explicitly. In any case there is no question of the importance of the problem, and it is encouraging to find an economist in the field of labor addressing himself to it.

Other interesting papers included in the volume on which space limitations permit no comment here are. "Logics and Emotions in Marketing," by Professor Teale; Professor Tosdal's on "The Study of Consumer Demand in Relation to Capitalistic Society;" Professor Malott's paper on the agricultural problem; and one on "Rate Making and Marketing Problems of Public Utilities," by Professor Ruggles

This is a useful collection of essays which economists and statisticians will wish to sample and reflect upon according to their tastes. And it is perhaps unnecessary to add that the reviewer's distribution of emphasis among the papers is not to be interpreted at all as reflecting his estimate of their relative merits.

NORMAN S. BUCHANAN

University of California
Berkeley

Industrial Price Policies and Economic Progress, by Edwin G. Nourse and Horace B. Drury. Washington, D.C.: The Institute of Economics of The Brookings Institution. Publication No. 76. 1938. xi, 314 pp. \$2.50.

Carrying on the thesis of Moulton's *Income and Economic Progress*, Messrs. Nourse and Drury consider the circumstances under which and the extent to which the business manager can contribute to national welfare by low-price policies. Their volume seems to be addressed primarily to business men, but its forceful challenge to accepted views of the problems of monopoly requires the serious attention of economists.

The book presents a vigorous sermon to executives of large corporations, delivered by friendly but thoughtful critics. The theme runs as follows: Since in many fields of manufacturing, maximum economy and progressiveness require very large units, executives are endowed with power over market forces. Their choice of policies determines how nearly capacity output and employment are approximated in the long run. (The book is not concerned with problems of the business cycle.) Restrictionist policies, attractive for

temporary profits, are likely to prove illusory as instruments of long-run gain and are, in any event, antisocial. Only through continuous progressive improvements and price reductions can the system of free enterprise under private capitalism realize its great potentialities. Since the World War a growing number of business men have adopted constructive low-price policies implemented by ingenious advances in technique or organization, of which numerous examples are given; but many other business men, understanding imperfectly their long-run advantage or their social responsibilities, continue to pursue restrictionist policies. The text of the appeal addressed to these is, to paraphrase: be good, big boy, and let who will be high-priced.

The book opens with brief statistical surveys suggesting that workers' real purchasing power for manufactured products grew much more rapidly in the two periods 1870-92 and 1918-37 than in the intervening period of flowering trusts, and that since 1918, at least, manufacturing profits have not increased more rapidly with rising prices than with moderately falling prices. The middle portion of the book is then devoted to exploration of the sorts of changes in quality, type of goods, processes, scale of organization, and pricing policy which result in satisfying more wants at prices within the incomes of the mass of buyers and hence promote capacity operations; to discussion of the relations between cost and prices; to examination of market responses to price reduction and to various methods of sales promotion; and to consideration of influences on the price-maker of custom, bankers, and trade associations. The next section surveys the general changes in the structure of industry, market patterns, and competitive forces, and treats group solidarity and Government participation in price-making. The authors' thesis is well summarized in the final chapter. Throughout the book it is suggested vigorously to the executive that an understanding of the concrete manifestations in his own business of the matters here discussed will lead him to eschew restrictionist types of sales promotion, accounting procedure, and pricing, and to shake off such pressures from trade associations or bankers as hamper the aggressive prosecution of low-price policies.

To economists and others interested in public policy this book is important because it contains a sharp challenge to those views of the problems of big business which emphasize the ineffectiveness of competitive forces and the wastes of monopoly; and because it implies a denial of the present desirability of more Government control in industrial markets or of change in the antitrust laws. The authors evidently believe that problems of monopoly first need more attention from business executives.

Their position is not, however, entirely clear. They argue that in the last quarter century growth in the number of large firms operating in a common market and the aggressive application of industrial science in widening the range of substitutes have made competition keener and more effective in stimulating progressive advances and in carrying their benefits to consumers. How pervasive such competitive forces have become is not disclosed, for quantitative study of the question is not attempted. That the authors be-

lieve there are many markets in which monopolistic policies have not yet been replaced by this "dynamic price-making" is attested by their energetic endeavor to convince business men that enhanced progressiveness and price reductions will ordinarily yield more profits in the long run than restrictionist policies. But some doubts as to the general truth of this proposition are evidenced by their failure to state it explicitly and by their pains to stress the social responsibilities of the corporate executive. The plain implication of all this is that if the plea of Messrs. Nourse and Drury—and of several business leaders whom they quote—goes largely unheeded, we shall find ourselves with just what we now have, serious monopoly problems.

The authors attack the customary practice of approaching these problems from some sort of equilibrium theory which they think misconceives the social problems involved through failure to emphasize the dynamic elements from which progress comes. To say that in launching an offensive they have neglected the solid merits in the hypotheses raised by the theory of monopolistic competition is not to detract from the force of their objection to this serious shortcoming. Although they have thrown a spotlight on neglected dynamic forces and have set up hypotheses which The Brookings Institution might well examine quantitatively, they have not developed an integrated set of principles, embodying the important dynamic elements, which can be used in practice to make the qualitative distinctions and the rough quantitative measurements necessary to distinguish socially desirable market situations and policies from the undesirable. It is to be hoped that they will next turn their efforts in this direction.

Two more points may be made. First, the authors appear to contend that if most companies achieved continuous progressive advance and lowered prices in step with costs there would be no important monopoly problems. This contention is highly questionable. Continuous reductions in price corresponding to reductions in cost are quite consistent with a very considerable amount of monopolistic restriction, evidenced in large profits, waste in sales expense, or idle capacity. The most perfect monopoly bent on maximum profits would lower price continuously with cost reductions, if elasticity of demand were greater than unity.

Finally, Messrs. Nourse and Drury evidently believe that the best way of realizing the immense potentialities of the modern economy is to invest the few executives of great corporations with large power over economic forces and education in simple economics. This advocacy of the concentration of power in the hands of economic rulers who are selected by a half-understood process, often hit-or-miss, and are accountable to the people in no effective way for misuse of power, echoes the hope of Berle and Means for a "neutral technocracy" of corporate executives balancing the interests of all groups, although directly responsible to nobody. To those who cherish the traditions of democratic liberalism this will seem despairful counsel.

DONALD H. WALLACE

Harvard University

Balances of Payments 1936. Geneva: League of Nations, Economic Intelligence Service. New York: Columbia University Press. 1937. 236 pp. \$1.50.

This is a collection of the balances of international payments of 36 countries, mostly for the calendar year 1936. The like symposium, for 1935, was reviewed in last December's issue of this JOURNAL by the present writer. That review noted the marked decline in the number of countries compiling balances of payments, as depression and militarism continued. It commended the ingenuity or conscientiousness of the compilers for The Netherlands, France, Canada, and Latvia—leaders, all, in constructive thinking in this field, nowadays. It discreetly skipped past the sad exhibits in the American section, methodologically speaking, and roundly censured the stereotyped methods of the United Kingdom compilers as well as the stereotyped presentation of the Britishers who edit for Geneva.

The Geneva editors seem different in the present volume. Their generalizations respecting movements of goods, services, loans, and gold in 1936 are especially scholarly. Their long section on "General Tendencies" is penetrating, vivid, lively.

Whatever complaint the reviewer might suggest, against the editing this year, touches only the statement (p. 8), "no attempts have been made to present the information for each country in accordance with the detailed standard form sent out to governments." Despite that statement, nearly every one of the 36 tables appears in standardized form. I still hold, from last year, that "the League would do better by reprinting the balance-of-payments tables of the various countries, just as they were originally presented—no individuality or local color lost." This would not interfere, of course, with the excellent "synoptical" tables constructed by the editors themselves. In this field we may go far, yet, in improved presentation.

Still valid, I think, is my last year's criticism of the League editors' failure to signalize or salute new contributions to methodology. Consistently they seem to prefer product to process. At the present embryonic stage of this science, is it not less important to reprint, for example, the fantastically erroneous and misleading estimate of America's net movement of capital in 1927 (an *inflow* of \$783 million) than to record processes later invented whereby such blunders can be avoided? Every advance in methodology made by any of the 36 compiling countries should be faithfully noted in a separate section by the editors.

Scientific method in balances of payments, as elsewhere, consists of collection, classification, and generalization. The collecting process in this field is fascinating and picturesque—if at times downright provoking. A seemingly water-tight tub becomes a leaky sieve whenever some agile-witted foreign compiler pops up with a brand-new invisible item overlooked by everybody. New, picturesque, or unusual invisible items of international trade, from the present volume, follow:

Australia—Upkeep of soldiers graves abroad; overseas mail subsidy.

Belgium—Seasonal workers.

Egypt—Annual pilgrimages to Mecca.

Germany—"Undefinable capital movement."

Hungary—Hire of railway wagons.

Iraq—Pension contributions to foreign officials.

Irish Free State—Net receipts from Hospital Sweepstakes.

Latvia—Payments of Latvian newspapers to foreign correspondents.

Netherlands—Government assistance to Dutch nationals abroad.

Norway—Whale oil sold from herding grounds.

Poland—Charges for loading and unloading ships.

Sweden—Lottery tickets.

Union of South Africa—Recruiting expenses for tropical natives in mining industry.

United Kingdom—Royalties for American sound-film apparatus.

Venezuela—Silver coin exported for reminting.

Two of the foregoing invisibles seem never to have been investigated by any American compiler. The Polish compiler raises the question of loading and unloading ships. The Latvian compiler opens up the whole field of news syndicates in international affairs. Both these new items may be "miniature invisibles" in the American table of payments—too small to record. Again, maybe not

Note that these contributions to methodology came from smaller countries. Clearly the ability of compilers has little to do with the size of their countries. The Bulgarian and Greek compilers also win laurels—these for their handling of their "preliminary net discrepancy due to errors and omissions." By paradox, that net discrepancy is the one completely reliable figure in a balance of payments. With it and a table of maximum comparisons one can sometimes perform near-miracles in the localizing of errors.

The Bulgarian compiler (p. 72) threw his net discrepancy into his commodity trade, where he perhaps positively knew it originated. The Greek compiler (p. 125) put his preliminary net discrepancy into "yield of Greek investments abroad" in 1929-31 and into "unascertained foreign assistance" in 1933-34; in 1935-36 he let it stand. Several countries have long thrown all or part of their preliminary discrepancies into movement of capital, short-term or long-term: their least visible item. Obviously this solution makes sounder sense than the shadow-boxing of the compilers for Canada, Iraq, and Sweden in this volume; these declare that their capital-movement figures caused their discrepancies—and do nothing about it.

Under this topic of discrepancy fluctuations, the Soviet compilers are a breed apart. They report no discrepancies, preliminary or final, in their balances of payments. Their figures (p. 199) are compiled "from exact information concerning the foreign transactions, available in the bookkeeping departments of the Soviet economic organizations." Contraband is indulgently presumed not to exist.

The American section of the League symposium specially concerns readers of this JOURNAL. The figures therein are those issued by the Commerce Department. This is unfortunate. General untrustworthiness of those figures was established about two years ago by the National Industrial Conference Board, in an investigation costing upward of \$20,000 and extending some 16 months. The Board listed more than 50 arithmetical errors in the Department's 1931 Bulletin and just 122 in the 1932 Bulletin. The 1933 and 1934 Bulletins were found to be similarly honeycombed with errors, but no formal listing of them was made. Typed lists of the 1931 and 1932 errors were supplied at different times to the Department of Commerce, which has nevertheless continued (with the same compilers) to reprint, in its comparative tables, all or nearly all its original errors. Incidentally, those "comparative" tables have hardly any comparability at all, because of radical changes in estimating methods and in classifications.

The Board publication—"International Transactions," by the present reviewer and associates—devoted scores of pages to explaining corrections or necessary adjustments in the Department's figures. It contains a vastly improved comparable table for the period 1922-34: the only strictly comparable one for that span of years. Its adoption by the League of Nations, for those 13 years, is emphatically to be recommended, in place of the "official" figures. After all, our Government is not a League member; and the Geneva editors are under no duress to print our "official" figures, save perhaps for such recent years as have not yet been privately audited and reconstructed.

RAY OVID HALL

Washington, D. C.

The World Crisis, by the Professors of the Graduate Institute of International Studies. Geneva, Switzerland. 1938. New York. Longmans, Green and Company. xii, 385 pp. 10/6 net.

This book celebrates the tenth anniversary of the founding of the Graduate Institute of International Studies at Geneva. It consists of a group of essays, one by each member of the staff, on phases of international relations within the sphere of the writers' special competence. Little attempt at organic unity is made. On the contrary it is expressly declared that the only link between the essays is the Institute itself. This is sufficient, however, to focus discussion on the struggle to effect the international organization of the world and to defend what has been achieved against the resurgent tide of aggressive nationalism.

Political and historical matters are treated severally by Professors Mantoux, Rappard, Bourquin, Ferrero, and Potter; legal problems by Professors Kelsen, Wehberg, Guggenheim, and Kaeckenbeeck; and economic questions by Professors von Mises, Röpke, Whitton, and Heilperin.

In the political, historical, and legal essays the League of Nations is the

central theme. Professor Kelsen argues for the separation of the covenant of the League from the peace treaties, and Professor Guggenheim discusses legal and political conflicts in the League as a preliminary to a consideration of whether, and how, it would be possible to develop the League into a community which would meet justifiable needs for change. Professor Mantoux, an insider, traces the fateful failure of the League powers to enforce League policy in the Polish-Lithuanian dispute of 1921, while the brighter episode of the Arbitral Tribunal of Upper Silesia is presented by the former President of that body, Professor Kaeckenbeeck. Professor Rappard contributes a judicious survey of the League's evolution as a whole and concludes that, with all its failures, it has established habits and attitudes so suitable to the needs of humanity as to insure its early resurrection if it should ever be dissolved.

The present crisis in international organization is carefully analyzed by Professor Potter, and the same service is performed by Professor Bourquin with respect to democracy at large.

Problems associated with war are treated by Professors Wehberg and Ferrero. The former deals with the somewhat neglected problem of civil war in international law and with the new issues now appearing in this field. Professor Ferrero makes a significant distinction between wars for limited ends and wars "retrospectively justified" with changing and ever wider aims. In the former, sacrifices are kept proportionate to the original aims, but, in the latter, the aims are progressively made proportionate to sacrifices already incurred. The fate of civilization is tied up with the choice between the two forms.

The necessity for a radical change of spirit in the political sphere as a condition of improved economic relations is prominent in all the economic essays. Professor Whitton, for instance, after proposing for the distribution of raw materials a code of fair practice, to be made effective through international legislation, states that economic and political disarmament are indissolubly tied together and that both must be brought about at one and the same time. The conclusion is impeccable but not very heartening, and it nullifies much of the essay. The struggle for raw materials is surely the consequence rather than the cause of a warlike attitude. So long as that attitude persists there can be no mutual interest in codes of fair practice and, if the attitude should be reversed, the codes would be all but superfluous. This is recognized by Professor von Mises who, in a review of the evils of economic autarchy and its weaknesses even from the point of view of its authors, roundly declares that what the world needs is not more conferences and conventions but a radical change of mentality.

Professor von Mises sees no hope in anything but a return to, and development of, the economic system which reached its apogee, thus far, in the third quarter of the nineteenth century, but Professor Röpke, in his essay on International Economics in a Changing World, is somewhat more compromising. This is not because he is less skeptical of the prospects of

planned economies but because he is more impressed by the strength of the forces which have produced them. Acutely conscious of the ills that affect, and the greater ills that threaten, this troubled world, his thoughtful paper is a little disappointing in that it stops short with a prescription of "constructive liberalism," with little indication of what the specific content of that phrase might be.

Professor Heilperin's concluding essay on monetary internationalism is a well-developed argument from what the reviewer believes to be an untenable assumption. The assumption is that absolute stability of exchange rates is essential to satisfactory commercial and financial relations of an international character. This dubious hypothesis forces Professor Heilperin to call for the sovereignty of international over conflicting national monetary policies. It is certainly no overstatement to say that this is the hard way to attain his end. If, instead of absolute stability of exchange rates, an attempt were made to adjust rates proportionately to shifts in the relative domestic purchasing powers of the several currencies it would be possible for any nation to pursue whatever internal monetary policy it judged appropriate to its interest without significant disturbance of international commercial and financial relations. This is not the place to argue the matter. It seems indisputable, however, that progress in international affairs is dependent upon the reconciliation, rather than the overriding, of legitimate national interests and that the national right to an independent monetary policy will not, and should not, be surrendered.

It is impossible within the space of a short review to do justice to all the writers of these essays, and to concentrate attention upon any one or two of them would be invidious to the others. Every one of the papers is a thoroughly competent exposé of the topic selected and, in spite of its lack of unity, the book is instructive and interesting from cover to cover

FRANK D. GRAHAM

Princeton University

Our Trade with Britain, Bases for a Reciprocal Tariff Agreement, by Percy Wells Bidwell. New York: Council on Foreign Relations, 1938. x, 129 pp. \$1.50.

Prior to the official negotiations for a reciprocal trade treaty between Great Britain and the United States, the Council on Foreign Relations had undertaken "a study of the trade and tariff policies of the United States and Great Britain to consider the pros and cons" of a possible treaty. The study was carried on under the general direction of a distinguished committee which invited Professor Bidwell to write the report. The author was left "entirely free to express his own opinions" and conclusions. His summation constitutes the small volume now being reviewed.

Professor Bidwell offers in five successive chapters an analysis of American and British commercial policies, together with their influence on the respective exports and imports of the two countries. This lays the basis for his

sixth and final chapter dealing with the "prospects of an Anglo-American trade agreement."

The author sees much that the two powers have in common, in spite of the fact that "historically England has stood for Free Trade and the United States for Protection." He points to the similar methods of applying import duties, the "common adherence to the principle of equality of treatment in their commercial relations with foreign countries" and the use of the most-favored-nation clause. He also foresees mutual benefits resulting from a reciprocal trade agreement which might prove "a landmark in economic history" and a positive benefit to world trade. He understands, as well, that trade revival constitutes a common problem.

Bidwell adduces statistics (19 tables in the text and 8 in the Appendix) to show that the United Kingdom was our best customer in 1937 and that, although we purchased an amount equalling but 6 per cent of her total exports, these latter paid high duties when imported into the United States. An analysis of the goods, moreover, shows that they are in part complementary and in part competitive. He also notes the fact that together with the United Kingdom we have dominated the trade of the British dominions although Japan has made some headway in recent years.

Referring to the revision of the American tariff in the treaties already made with 17 countries, the author believes it has "proceeded with great caution" and that "there has been no wholesale slashing of rates." He suggests that perhaps "‘nibbling’ would best describe the process." Nevertheless, "the cumulative effect on the tariff system of the United States, and on that of other nations, may prove of great moment."

The study is a skillful presentation and consideration of the issues and concessions involved. It shows an understanding of the possible benefits to all concerned and the sacrifices that might have to be made. At the same time, it recognizes the organized opposition that such a treaty may face on both sides of the water and anticipates the part that the British dominions will play. The successful negotiation of the treaty will depend on the attitude of public opinion in both countries. Although not undertaking to state what British opinion might be, he believes that popular support will be forthcoming in the United States—"not so much on the careful calculation of economic advantage as on the strong hunch that in the present confused condition of the world, freer trade points toward peace." An excellent bibliography concludes the volume.

ASHER ISAACS

University of Pittsburgh

Japan in Transition, by Emil Lederer and Emy Lederer-Seidler. New Haven, Connecticut: Yale University Press. London: Humphrey Milford. Published for the New School for Social Research. 1938. xi, 260 pp. \$3.00.

This book, though far from being written as a statistical study, will be of value to anyone interested in formative influences on modern civilization,

as it is primarily an analysis of how these forces direct modern Japan. Though based on a former German publication of the authors, the present work has been greatly revised, after a two-year residence of Professor and Mrs. Lederer in Japan. While teaching at Tokyo Imperial University, Professor Lederer came into direct contact with a Japan in transition about which he writes, thus making his comments all the more valuable.

The authors treat with varying degrees of success such divergent subjects as religion and mythology, the cultural background since 1600, the written script, and a very thought-provoking and interesting section, the force played in Japanese life by conventions with the resultant subjugation of the individual. Following an analysis of the State in both China and Japan, the theme shifts to foreign contacts, foreign policy and elements in economic development which have forced Japan's activities along specific lines. Industrialization followed closely behind the growth of "the army which represented the technological high-water mark" of the country.

"Just as militarism reaches beyond itself into industry, so the technological system of industrialism has far-reaching implications for the social system. Here lies the heart of the problem of Westernization. It is not the machine in itself, as has often been supposed, but the social impact of the whole industrial system—especially the militaristic industrial system—which threatens Japanese culture" (p. 181).

Furthermore, it is pointed out that the success of the army against China and Russia vindicated the movement toward militaristic industrialism. Thus the Japanese have become more aggressive in China, which has increased in intensity since 1931 (p. 209) until things reached such a pass in the summer of 1937 that:

"From the standpoint of China, everything except the lease of Liaotung, the treaties involving the South Manchurian Railway, and similar matters, was illegal and therefore the earlier situation should have been restored. From the standpoint of Japan, China was not an equal, since she is not a state, and the 'mission' of Japan in the Far East necessitated measures which could not be confined within the framework of treaties" (p. 215).

So a mere incident, receiving impetus from recent activities of Fascist states and an increasing national movement in China, developed into a real struggle. Various basic economic troubles, such as the low value of capital equipment, the high proportion of national income for state expenditures, the high percentage of tenant farmers on the one hand and scarcity of land on the other (pp 229-33), have become intensified and result in pressure for industrialization which in turn "displays peculiar characteristics which result from poverty in natural resources and from the persistence of traditional modes of life and labor" (p. 236).

Possibly the first part of the work would have been stronger if the scope had been more restricted, for it is in the last section on economic problems that the authors are the most convincing, their arguments being well supported by figures. Some details do not appear to be historically accurate. Hachiman, the god of war, is erroneously identified with the Emperor Ojin

of the late fourth century A.D., not the third (p. 23). In spite of a policy of seclusion started in 1633, Japan was far from "completely cut off from the outside world" (p. 46) during the Tokugawa period; witness the continued Dutch commerce, the Russian encroachments during the nineteenth century, the various British and American vessels from the end of the eighteenth century, and the signing of the first treaty with America as early as 1854.

That "nothing new was absorbed even from China" during the same period (p. 64) is equally false for what of the *Rangakusha*, that courageous group of physicians led by Sugita Gempaku who studied Dutch learning, principally medicine, in the 18th century? "Even from China" the stereotyped philosophy of Chu Hsi was adopted as standard by the Tokugawa family, the teachings of Wang Yang Ming (1472-1529) were first interpreted and studied, and such a political emigre from the Ming Court in China as Chu Shun-Shui (1600-82) personally directed the compilation of "The History of Japan." Such misstatements as these naturally reduce the value of this section of the work particularly.

There is an apparent inaccuracy in the remark that the population remained stationary after 1720 and amounted to 26,000,000 in 1726 (p. 226). Dr. Yanagisawa, one of Japan's leading statisticians, states that in 1721 there was a non-warrior population alone of 26,065,423 and by 1852 that section of society had increased to 30,000,000.

In conclusion, however, it must be noted that the dramatic transition of Japan has been admirably treated and the problems have been not only approached in a masterful way but treated in a pleasing style.

HUGH BORTON

Columbia University

Commercial Relations between India and Japan, by C. N. Vakil and D. N. Maluste. New York: Longmans, Green and Company. 1937. Studies in Indian Economics, No. 12. xiii, 210 pp. \$3.75.

Inasmuch as Mr. Vakil is a Professor of Economics in the University of Bombay and Mr. Maluste is a former University of Bombay student, one opens this book in expectation of finding an informed treatment of the subject. This early judgment is reinforced as the reader progresses from page to page. The first 87 pages deal with the phenomenal development of industry in Japan since the middle of the nineteenth century. The material is not new, but it is well selected and effectively presented. The extent to which Japan is deficient in basic raw materials and fuels, her dependence upon intensive agriculture and foreign trade, and the hazards of her economic position are clearly and effectively analyzed.

Pages 88 to 149 of the book trace in some detail the currents of trade between Japan and India during recent decades. In many lines of light manufactures, Japan is getting a larger and larger proportion of a shrinking

aggregate volume of Indian imports. These Japanese goods compete with developing Indian industries. On the other side of the transaction, Indian cotton growers depend upon the Japanese market to absorb about one half of their total raw cotton exports. These circumstances, together with a series of Indian tariffs aimed at Japanese goods during the nineteen twenties and early thirties and a retaliatory Japanese boycott aimed at Indian cotton in 1932, led to the Indo-Japanese Trade Agreement of 1934. This agreement is analyzed in pages 177 to 191, and the text of the agreement is reproduced in Appendices I and II.

One of the interesting features of the book is a frank recognition of the superior efficiency of Japanese workers as compared with Indian workers. Causes of Japanese efficiency and reasons for Japan's success in manufacturing are examined. The reader closes the book with an idea, indirectly acquired, to the effect that India's industrial development, although slower than that of Japan, rests upon a firmer foundation.

HUGH B. KILLOUGH

Brown University

Common-Stock Indexes 1871-1937, by Alfred Cowles 3rd and Associates. Bloomington, Indiana: Principia Press, Inc. Cowles Commission Monographs, Number 3. 1938. xii, 499 pp. \$6.00.

This volume contains the results of a statistical investigation conducted on an heroic scale. Fifty of the 500 pages are devoted to a discussion of the purposes, methods, and principal results of the inquiry; another dozen pages contain charts depicting certain of the indexes developed; the remainder of the book comprises the indexes themselves. The basic data employed are the prices, earnings, and dividend payments of all industrial and utility common stocks, and about 93 per cent of the market value of all railroad common stocks traded on the New York Stock Exchange in the period 1871-1937. The end-product is seven indexes computed for each of 59 groups of securities, classified by industry, and for 10 combinations of the individual groups, or 483 indexes in all. Three of the indexes are on a monthly basis and four on an annual basis.

Anyone who has ever attempted to investigate the actual behavior marketwise of common stocks or to trace the history of funds invested in common stocks will appreciate the difficulties this inquiry has overcome and the great amount of labor required for its completion. In making this study the authors have been faced with an exceedingly long series of questions having to do with both policy and technique. What should be the precise goal of the investigation, and in exactly what form should the results be presented? In what manner and in what groups should the stocks be classified? How should corrections be made for stock split-ups, dividends, and the sale of rights? How should those stocks be treated whose quotations

either are discontinuous or disappear entirely? What, if any, allowance should be made for intercorporate stockholdings? The solutions found for these and other problems on the whole are satisfactory. Certain of the assumptions the authors have made in developing their procedures can, in some respects, be questioned, and certain of their decisions may seem a little arbitrary. But the postulates of any investigation of this sort, from the nature of the case, must be bold; and the critic of the authors' scheme must assume the burden of indicating a better course.

The seven indexes compiled are for stock prices excluding cash dividends, stock prices including cash dividends, yield expectations (the prevailing dividend rate multiplied by the number of shares outstanding shown as a percentage of total stock values), yields, dividend payments, earnings-price ratios, and earnings. The methods by which the indexes have been put together are carefully explained in the text. The indexes have been computed for such groups of securities as: automobile tires and rubber goods, beverages leather, and lead and zinc. Only nine of the categories extend over the whole period 1871-1937; but the profile of Chart I, showing the date at which each index begins, affords an interesting bird's-eye view of the growth of American industry during the past 60 years.

A few of the groups of stocks appear to be catchalls for securities difficult to assign to other categories, rather than classifications with a clearly defined nature, and consequently the indexes computed for them seem of doubtful value. The miscellaneous service classification, for instance, contains, among others, the stocks of the Adams Express Company, the Commercial Credit Company, the American Pneumatic Company, the New York Dock Company, the Chicago Yellow Cab Company, and the General Outdoor Advertising Company. The finding that this classification was the most profitable for investors during the entire period 1871-1937 seems of little significance.

The section dealing with the relationship of corporate earnings reinvested—found to average annually 2.5 per cent of the value of corporate stocks in the 1871-1937 period—with the annual average rate of increase in the value of stocks—found to be 1.8 per cent—seems to be one of the less happy portions of the book. The discussion of this point apparently assumes that the discrepancy is sufficiently illogical to require an explanation—an assumption it would be difficult to defend—since a number of possible explanations are canvassed. None of the hypotheses offered, however, seem to recognize that if all the earnings of corporations had been paid out during this period, or even if a considerable portion of those retained had been disbursed, the course of stock prices would almost certainly have been radically different from what it was. The conclusion which the authors appear to favor, "that during the last 67 years common stocks in the United States have in general sold at about 72 per cent of their true value" as measured by the return to the investor, certainly seems open to grave suspicion.

Viewed as a whole, this volume is a valuable addition to the literature dealing with securities and security prices and will be of much assistance not only to the financial analyst but also to the economic historian and economic theorist.

CHARLES CORTEZ ABBOTT

Harvard University

Monetary Policies of the United States, 1932-1938, by James Daniel Paris, with a foreword by Benjamin Haggott Beckhart. New York: Columbia University Press. 1938. xv, 198 pp. \$2 75.

In the foreword to this volume Professor Beckhart observes that in "detailing the monetary enactments and policies" and in the "evaluation of the results" the author "has furnished a *vade mecum* for all monetary students." This endorsement, in the parlance of bankers, provides two-name paper and enhances the marketability of the instrument. But the standing of the endorser—to pursue the analogy—does not relieve the reviewer from examining the maker's own commitments and the underlying transaction.

The text of the book consists of three main sections tracing the development of policy with respect to gold, silver, and note issue, respectively. The term "monetary policies" is thus applied narrowly, excluding, except for incidental mention, budgetary policy, banking policy, and foreign exchange developments. Approximately two-fifths of the book consists of chronologies and reprints of monetary laws and presidential messages bearing thereon.

Many monetary and non-monetary measures have contributed to the changing economic situation since 1932, and sharp differences of opinion have existed with respect to the efficacy of Government policy at these points. The author emphasizes the inconsistencies involved in a number of these measures, and his own conclusions and suggestions may be indicated briefly. He states that the "gold policies of the Administration have failed signally to reach the goals set up" (p. 108). He argues that "the President's power to change the dollar ought not to be extended when it expires" (p. 114) and that "the dollar ought permanently to be left at its present weight" (p. 114). He observes in connection with the silver policy that "none of the objectives sought was obtained" (p. 109) and that the Purchase Act should be repealed (p. 114). He approves of the retirement of the national bank notes and suggests that Federal reserve bank notes should "be buried once for all" (p. 111). He recommends that the "Glass-Steagall amendment relative to the Federal Reserve note should either be repealed or made permanent" (p. 114).

Probably the analysis of silver policy is most satisfactory. There are important aspects of the gold question which the author does not explore in reaching his conclusions, and there are grounds for disagreeing with the conclusion that we abandoned the *de facto* gold standard a second time in 1936

when we limited gold exports to stabilization fund transactions (pp. 36-37). The reviewer disagrees also with the banking theory which leads to the conclusion that "it is deplorable" that the Federal reserve note has ceased "to fluctuate with the ebbs and flows of business, as reflected in bills, acceptances and other available eligible paper" (p. 110). In arguing that there was little need for the Federal reserve bank note "even in an emergency," the author apparently overlooks the fact that the utilization of an asset currency has been a traditional method of coping with panics.

Dr. Paris has provided a detailed account of monetary developments which should be useful for reference purposes, but the "evaluation" is at some points incomplete and superficial.

LEONARD L. WATKINS

University of Michigan

Tax Relations among Governmental Units, by Roy Blough *et al.* New York: Tax Policy League, Inc. 1938. vi, 226 pp. \$2.75.

In this timely book a number of the problems in the fiscal relationships of our 175,000 units of government are discussed in an interesting and able manner. It consists of 16 papers that were presented at the annual meeting of the Tax Policy League in 1937. The general topics treated include Federal and state relations in the field of taxation, Federal and state aid, and state control of local finance. The book is a welcome addition to the literature of public finance at a time when the complexities of American taxation are a source of serious concern and the problems of taxation are daily becoming more acute.

The symposium reveals some of the difficulties that arise in an effort to secure a better coordinated system of taxation. Much talk has been devoted to the need for such coordination and the methods of securing it, but progress in the direction of a more harmonious system of taxation is realized only slowly. In dealing with these problems the Federal centralization of administration offers alluring possibilities of obtaining more consistent, simple, convenient, and equitable taxation, but the price is a loss of local democracy. Perhaps the conflicts, irritations, and inequalities in American taxation are not an unreasonable sacrifice to make for the preservation of a democratic form of government. It is to be hoped that Federal, state, and local governments will find it possible to cooperate voluntarily in an effective program of coordinated fiscal relationships, without the necessity of centralizing all administration in the hands of the Federal Government. The deciding factor is likely to be the policy followed by the Federal Government in taxation and other fields, since the state and local governments are largely at its mercy. The reader who attempts to secure a better understanding of these problems will find these papers thought-provoking and constructive.

ALFRED G. BUEHLER

University of Vermont

The Call Feature in Municipal Bonds, by the Committee on Municipal Debt Administration. Chicago, Illinois: Municipal Finance Officers' Association of the United States and Canada. 1938. ix, 118 pp. \$1.50.

This book presents a thoroughgoing study of the subject of the call feature as related to municipal bonds. Attention is directed to the fact that the call feature has been used much less widely in municipal bonds than in private corporate bonds. This fact is only partly explained by the larger proportion of serial issues among municipal bonds than among corporate bonds. It is a pity that this book could not have been placed in the hands of municipal finance officers 20 years ago. In the present period of low interest rates those municipalities having outstanding bond issues with a call provision have been able to effect substantial savings in their debt service by exercising the option of redemption and refunding the debt at lower rates. A great number of municipalities have awakened sadly to find that the lack of a call feature in high coupon bonds issued in the 1920's precludes the possibility of refunding at rates representing savings of from one-fourth to one-half of the old coupon rate.

From the investor's point of view optional bonds generally are less satisfactory than noncallable issues, but the experience with corporate issues clearly shows that investors will buy optional bonds when the issue is properly set up. The recommendations of The Committee on Municipal Debt Administration of the Municipal Finance Officers' Association for the increased use of the call feature take into account primarily the interest of the issuing municipality but to some extent also the interest of the investor. The present period of low interest rates appears to afford less opportunity for issuing callable bonds on which later refundings at a saving are likely to be made than would be the case with issues in a period of high interest rates, but one cannot be certain that the low rates of the present day may not be further reduced if the existing monetary policy is long continued. The possibilities of the call feature in municipal bonds deserve a wider and more intelligent consideration than they have had heretofore. This little book makes a valuable contribution in that direction.

CARROLL D. SIMMONS

The University of Texas

The Economics of Corporate Saving, by J. Ellwood Amos. Urbana, Illinois: University of Illinois Press. Illinois Studies in the Social Sciences, Vol. XXII, No. 2. 1937. 136 pp. \$1.50.

The scanty attention which the theory and actuality of new-capital saving by corporations had received before 1936 was embarrassingly revealed by the discussion during that year of the President's undistributed surplus tax proposal. The chief aim of this short book is to point out the existing inadequacy of theory as well as statistical raw material for thorough

analysis of the phenomenon. Economists have been painfully aware of the lack, evidenced by the inability of their colleagues either to marshal or to analyze arguments concerning the tax proposal, *pro* or *con*.

On the other hand, the special subject of corporation finance has long been aware of the importance of corporate saving; but in only a special sense—as a source of new capital for a growing enterprise. The author turns to standard treatises in this field for much of his very scanty analysis of the motivation or “theory” of corporate saving. The reader looks in vain for expansion of the analysis much beyond the borders set by writers on corporation finance. The effects upon capital allocation in society, the responses of corporate saving to various stimuli, the institutional influences upon it, and the changes in such saving in various phases of the cycle—all these are points of theory which are only suggested.

Searching for usable statistics, the author found an amazing inadequacy and confusion in the studies made by individual investigators (Friday, Knauth, et al), and by such groups as the Brookings Institution and the National Bureau of Economic Research. Treasury statistics he finds freighted with inseparable waste products in such a way as to defy exact reduction into usable figures. Not even proper estimates of the new capital needed for replacement as distinguished from new instruments of production can be made. Much of the first half of the book is concerned with surveying this unsatisfactory material. Some effort is made to analyze the sources of saving by groups and types of corporations, for which the author uses Government data.

An adequate though not vigorous summary of arguments (on both sides) concerning the undistributed profits tax occupies about one-fourth of the study.

SHAW LIVERMORE

University of Buffalo

Wheat Studies of the Food Research Institute, Stanford University, California.

“The World Wheat Situation, 1936–37, A Review of the Crop Year,” by Joseph S. Davis. Volume XIV, Number 4. December, 1937. pp. 103–82. \$1.25.

“Monetary Influences on Postwar Wheat Prices,” by V. P. Timoshenko. Volume XIV, Number 7. April, 1938. pp. 263–318. \$1.00.

“Price Effects of Canadian Wheat Marketing,” by Holbrook Working. Volume XIV, Number 2. October, 1937, pp. 37–68. \$1.00.

“Trends of Yield in Major Wheat Regions since 1885. Part I, General Considerations and Rising Trends,” by M. K. Bennett. Volume XIV, Number 3. November, 1937. pp. 69–102. 75 cents.

"Trends of Yield in Major Wheat Regions since 1885. Part II, Irregular, Stable, and Declining Trends," by M. K. Bennett. Volume XIV, Number 6. March, 1938. pp. 223-61. 75 cents.

"World Wheat Acreage, Yields, and Climates." Volume XIII, Number 6. March, 1937. pp. 265-308. \$1.25.

"Soviet Agricultural Reorganization and the Bread-Grain Situation." Volume XIII, Number 7. April, 1937. pp. 309-76. \$1.00.

"The World Wheat Situation, 1936-37," opens with a brief summary of certain general economic and political developments which influenced considerably the factual situation in respect of wheat. During the year there was a civil war in Spain, a spirit of uncertainty and fear which was accompanied by widespread retention of national self-sufficiency policies, an abandonment of their former gold parities by the so-called "gold bloc" countries, a continuance of general business recovery, a decided increase in the volume of international trade together with some slight reduction in trading barriers, an outbreak of industrial strikes in the United States, and higher prices for farm products as a class.

In regard to supplies, emphasis is placed on the smallness of the 1936 crop and the reasons therefor. Low yields are shown to have more than offset the influence of large acreage sown. Yields per acre were in most cases below the average for the preceding 10 years, while the average yield of the four chief exporting countries was smaller in 1936 than in any of the preceding 17 years. Generally speaking, however, quality was good. On the demand side a factor of major importance was the large-scale use of wheat for feed in certain countries and especially in the United States. Under the heading of marketing it is shown that the disappearance of the surplus problems and the rise in price caused changes in Government policies. Less support was given to wheat farmers while consumers received more consideration. International trade in wheat and flour showed an increase for the first time in six years in 1936-37, the expansion being due mainly to more effective demand in the European importing countries. The expansion in international trade in commodities generally created an added demand for shipping and was mainly responsible for a striking rise in ocean freight rates. Between July, 1936, and July, 1937, the rate on the route from Australia to the United Kingdom rose 14 cents per bushel. Significant also was the fact that India exported considerable wheat for the first time in 10 years, while Egypt got into the net export ranks for the first time in more than 20 years.

The year was marked by a steady improvement in prices especially toward the year-end. Durum wheat, on account of extreme scarcity, became especially dear. The effect of price improvement was especially noticeable in the United States and Canada where aggregate farm returns were higher than for many years despite small crops.

The exhaustive study dealing with "Monetary Influences on Postwar Wheat Prices" is both enlightening and suggestive. Considerable ingenuity

is shown in evolving the study technique, while the conclusions reached are both numerous and quite definite. It is especially fortunate that the author decided to divide the postwar period into four parts and to treat developments in each of these separately. The analysis shows clearly not only the fact that monetary developments played an important part in determining the level of wheat prices but also the special kind and degree of influence exerted in this or that period. Those who have been accustomed to correlate changes in wheat prices with changes in the production of the commodity would do well to study this number carefully. The study surely suggests that those who would attempt wheat price stabilization measures must pay serious attention to possible changes of a monetary character.

Dr. Working's study on the "Price Effects of Canadian Wheat Marketing" should be most valuable to all who are interested in finding out the true meaning and economic significance of what is commonly called "orderly marketing." The conclusions reached are the result of studying "the changes in the relations between prices of Canadian wheats and of other wheats. The timing and rate of marketing affect these price relations much as they affect the absolute price, while most of the general price influences have little effect on price relations. The price effects of marketing are therefore more clearly observable in certain price relations than in the level of prices." The most significant conclusion reached is that variations in the rate of marketing have very little effect on the prices paid. The mere fact that seasonal variations in price may show a marked correspondence both in direction and extent with variations in the rate of marketing is held to be insufficient reason for assuming that the rate of marketing has a pronounced effect on price. While it is true that a price decline will accompany the marketing of a new crop, such a decline is more likely to be due to the fact that supplies have increased than to the rate at which such supplies are sent to market. This distinction between the fact that supply has changed and the rate at which supplies come to market is probably a very fundamental one. At the same time the relationship between rate of marketing and price given at the end of page 48 would indicate that the effect of an increase in supply is not altogether different from the effect of the rate at which marketing takes place. It is there stated that "the rate of farm marketing may be supposed a significant price influence only while daily deliveries are running *fairly large*."

In the study of yield trends (Numbers 3 and 6, Volume XIV) the world wheat area is divided into 14 regions. Of these, six are in North America, five in Europe and Northern Africa, one in Asia, and two in the Southern Hemisphere. In studying the yield trend in each of these regions it is recognized that many things may exert an influence on yield. The various influences are grouped into six classes. Where the regional yield has tended to increase, it is found to be due mainly to the development and use of new varieties and improvement in agricultural technique. Where yields have tended to decline, the main causal factor has been a shift from higher to

lower yielding areas. Such shifting has been possible mainly in the newer or more recently developed areas. In the older areas where settlement of the poorer as well as the better areas had taken place prior to the period being studied, the yield trend has been upward. One of the most valuable features of the study is the classification of the influences governing yield. While the results of the study do tend to show the relative strengths of the six types of influences under conditions as they have existed since 1885, it seems clear that the chief difficulty in forecasting future yield trends lies in the difficulty of predicting what changes may occur in the influences themselves.

For several reasons the appearance of a thoroughgoing analysis and evaluation of post-1930 developments in the agriculture of Russia is most welcome. Russian experience should have much to teach to those interested in selecting the optimum size of farm operating unit together with the type of business organization best fitted to own and control it. Moreover, Russia's actual and prospective ability to produce and export agricultural commodities is a matter of constant international interest and concern.

While the study is full of interesting information, special attention will be given the statement to the effect that yields per acre under collectivized methods have still to surpass those obtained on peasant farms prior to collectivization. Significant also, however, is the evidence of positive if gradual improvement in the matter of yields. Despite marked progress in the Government's ability to control collection and therefore exportation of grain, the prediction is made that Russian wheat exports are not likely to assume large proportions for several years at least.

W. M. DRUMMOND

Ontario Agricultural College

Wheat Studies of the Food Research Institute, Stanford University, California.

"World Wheat Survey and Outlook May 1937." Volume XIII, Number 8. May, 1937. pp. 377-406. 60 cents.

"World Wheat Survey and Outlook September 1937," by Helen C. Farnsworth and Holbrook Working. Volume XIV, Number 1. September, 1937. pp. 1-36. 60 cents.

"World Wheat Survey and Outlook January 1938," by Helen C. Farnsworth and Holbrook Working. Volume XIV, Number 5. January, 1938. pp. 183-221. 60 cents.

"World Wheat Survey and Outlook May 1938," by Helen C. Farnsworth and Holbrook Working. Volume XIV, Number 8. May, 1938. pp. 319-58. 60 cents.

Through mid-May, 1937, wheat exports were the heaviest in several years, notably from Argentina, stimulated by the high price level and favourable price spreads. Active purchasing by Italy, Germany, and Spain was responsible.

During May-September, 1937, the important development was the near failure of the Canadian spring-wheat crop which forced prices up. They fell later to a greater degree in Chicago than in Liverpool and Winnipeg. Despite the poor Canadian crop, total supplies were not expected to be much above last year, owing to lower world stocks of old crop wheat. World wheat price movements, September-January, were large yet differed widely in different markets. The authors point out that the large wheat price had uncommonly little connection with developments in the wheat situation itself. The wide divergence in price levels of different markets seemed due to sharp increases and decreases in ocean freights and premiums on different wheats, principally Canadian and Argentine over United States winters and vice versa. As the price spread varied, the influence of freight rates varied. For instance the Chicago-Liverpool spread narrowed rapidly from early November to late December yet without curtailing export sales from the United States because ocean rates declined 6 cents per bushel and premiums of United States winters advanced over the Liverpool future of Canadian and Argentine wheats during the same period.

With the moderate surplus in world wheat supplies chiefly in the United States, it was expected that Chicago might dominate prices in world markets. There was little change in estimates of wheat supplies, international trade, or 1938 carryovers. The increasing evidence of economic depression in the United States and international political developments coupled with prospects for increased wheat supplies in 1938-39 have initiated, in the United States markets, declines in world prices. World net exports were forecast at 535 million bushels for 1938 with year-end stocks 1938 about 100 million bushels over 1937 largely attributable to United States carryover of about 190 million bushels.

C. W. RILEY

Ontario Agricultural College

Mortality Trends in the State of Minnesota, by Calvin F. Schmid. Minneapolis, Minnesota. The University of Minnesota Press. August, 1937. ix, 325 pp. \$3.50.

Since Hermann M. Biggs wrote, "within natural limitations, any community can determine its own death rate," quantitative studies of community mortality data have aided greatly in the advancement of public health work. In this volume Calvin F. Schmid reviews the more important statistical data regarding mortality in the state of Minnesota for the past quarter century (1910-35). Individuals who are either engaged or actively concerned with public health will be interested in the contents. Public health workers, in Minnesota especially, will find the monograph of value in their daily activities and current procedures.

This type of material presents a difficult problem in arrangement. The sequence which the author has adopted undoubtedly will be acceptable to

almost everyone. From a discussion of the total death rate and the rate for certain causes over the 26-year period, 1910-35, he passes to a presentation of the principal causes of death in the biennial period 1932 and 1933. He next turns to mortality rates specific for age and sex, especially considering them as they are related to time and such other variables as: race, marital status, and certain specific causes of death. Following this, he introduces a discussion of infant and maternal mortality and seasonal variations in death rates. After a general presentation of comparative mortality in the registration area of the United States, the monograph closes with a consideration of the mortality in the twin cities, Minneapolis and St. Paul.

A volume could be written on any one of the above subjects. In presenting this monograph of limited scope the author hopes, however, that "this study may serve as an orientation for a series of more detailed investigations of mortality in the state of Minnesota." The selection of the important data for publication was undoubtedly difficult. It is to be noted that material of a more technical nature has been omitted. Many well constructed graphs delineated by the author are included. Because of limitation in space, the basic tables have not been published in many instances, the author feeling that "relative quantities can be grasped visually much more easily than is possible by means of mathematical or even verbal analysis." To anyone who is interested in more thorough study, the basic tables would be essential. Again, the standard population used in adjusting the changing age distribution of the population of Minnesota is given as a footnote, and no mention made of the method used in correction.

It will be found, however, that the appendix serves well in answering such criticisms, by including brief discussions of population changes, meteorological conditions and residence allocation, together with supplementary statistical tables. Allowing for the limitations stated above, however, the material is ably presented. Footnotes throughout the text and an extensive bibliography are important portions of the book, for they refer to more detailed discussions of the principal issues raised. Mention may be made also of the fact that the planograph method of reproduction was adopted for this publication. Graphic material, therefore, is faithfully delineated, and in general the text material is clear although the typing is not entirely uniform. On the whole the University of Minnesota Press may be credited with an entirely acceptable and thoroughly satisfactory publication.

EDWIN L. CROSBY

The Johns Hopkins University

Machine Politics: Chicago Model, by Harold F. Gosnell. Foreword by W. F. Ogburn. Chicago. The University of Chicago Press. Social Science Studies, Number XXXIII. 1937. xx, 229 pp. \$2.50.

This short book is packed with more political *science* than is found in a dozen of the more "brilliant" literary tomes on its subject. One unique feature of the present study, as contrasted with a large number of works on

this favorite subject by novelists, journalists, and academicians, is that Professor Gosnell tells us *how he knows* what he tells us. He leaves his tracks through the political jungles of Chicago so clearly marked that anyone may see how he arrived at his conclusions. From the scientific point of view, this must be hailed as a notable characteristic for a book on the political machine. For writers on this topic have hitherto relied chiefly on display of vocabulary, vigorous declamation, and irresponsible journalistic impressionism. The present work describes and analyzes actual political behavior. As was to be expected, some of the political lore which has been elevated to the dignity of science by frequent repetition requires considerable qualification in the light of Mr. Gosnell's findings. But more important than these findings in this particular case is the demonstration of methods by which valid answers to political questions can be found.

The depression resulted in a substitution of Democrats for Republicans in the Chicago machine but did not seriously affect the main pattern. Indeed, in the absence of a somewhat fundamental social reorganization it is difficult to see how a community could get along without its political machine. For this informal, nonlegal, and perhaps in parts even illegal social structure has arisen to fill needs for which the formally established political structure has failed to provide in a form which the citizen recognizes as adequate. The machine, therefore, is an entirely natural institutional growth which renders services that large numbers of citizens deeply appreciate. A glance at Chapter IV, "Activities of Precinct Captains," will provide ample specifications of what these services are. When accredited social workers take over these functions and perform them to the satisfaction of their clientele, the machine may disappear. Until then there is no reason to expect it to go out of business, or to change except in its adaptations to changing conditions as described by Mr. Gosnell. "As compared with his 1928 predecessor, the 1936 precinct committeeman in the city of Chicago was less of an employment broker, less of a tax-fixer, less of a traffic-slip-adjuster, but more of a go-between for the relief agencies and the various branches of the federal government" (page 90).

The first four chapters give an illuminating and very readable account of the personalities and characteristics of the politicians whose activities constitute the workings of a metropolitan political machine. Succeeding chapters are devoted to statistical analysis of voting behavior on various types of issues and the relation of the press to voting. Of special interest to the statistician in this connection is the use of multiple correlation and factorial analysis to unscramble the actual interrelationship among the various influences that operate in a given political result. The intercorrelation of twenty-three variables in this connection indicates a type of analysis upon which the social sciences must rely to an increasing degree. Three statistical appendices, a bibliography, and an index complete this excellent monograph.

GEORGE A. LUNDBERG

Bennington College

Data on the Growth of Public School Children (from the Materials of the Harvard Growth Study), by Walter F. Dearborn, John W. M. Rothney, and Frank K. Shuttleworth. Washington, D. C.: National Research Council, Monographs of the Society for Research in Child Development. Volume III, No. 1 (Serial No. 14). 1938. 136 pp. \$1.00.

It will be recalled that the Harvard Growth Study was initiated in 1922. The intention was to give physical, mental, and scholastic tests to approximately 3,500 children just entering the first grades of public schools in three cities in the vicinity of Boston, and to follow with similar measurements annually throughout the school careers of these same children. A longitudinal study covering 12 years has thus been made possible by the cooperation of The Commonwealth Fund, the Harvard Graduate School of Education, and the General Education Board of New York City. Clerical assistance was given also by the National Youth Administration and the Works Progress Administration. The present monograph gives the raw data for 747 boys and 806 girls selected for completeness of data and averaging more than 11 annual examinations each. Over 155 thousand physical measurements and over 33 thousand mental ages are here reported. Administrative and editorial procedures are given. An annotated bibliography of 75 titles gives the substance of "the most significant, published and unpublished studies which have been made with the materials of the Harvard Growth Study." Ninety-seven pages of finely printed material give for each of the 1,553 cases the following data: case number, sex, date of birth, ethnic stock, city, socioeconomic status, and age of first menstruation of girls. For each of the repeated examinations the following data are given: chronological age, standing height, sternal height, sitting height, body weight, head width, head length, iliac diameter, chest depth, chest width, number of permanent erupted teeth, skeletal age, and mental age. No interpretation or discussion of data is given.

FLORENCE M. TEAGARDEN

University of Pittsburgh

A Handbook of Methods for the Study of Adolescent Children, by William Walter Greulich, Harry G. Day, Sander E. Lachman, John B. Wolfe, and Frank K. Shuttleworth. Washington, D. C.: National Research Council, Monographs of the Society for Research in Child Development. Volume III, No. 2 (Serial No. 15). 1938. xvii, 406 pp. \$2.25.

The introduction to the monograph states that it has been prepared to serve as "a methodological aid for students of child growth and development and for others who are concerned with the diagnosis, treatment, guidance and education of children." The five authors had been given appointments as Fellows in Child Study by the General Education Board and worked at Yale University in connection with the School of Medicine and the Institute of Human Relations.

Part I, consisting of 70 pages, 10 tables, and 29 figures, deals with Anthropometry and was prepared by Dr. Greulich. Methods and tools of measurement are listed and discussed for each of the following sub-topics: anthropometry, skeletal development, skin and associated structures, and genital changes (male and female) associated with puberty. The literature on each topic is reviewed, and bibliographies are given.

Part II has to do with Biochemical and Physiological Aspects and was prepared by Dr. Day. The skin and associated structures, blood, respiration and energy metabolism, digestive organs and functions, and urine and feces are discussed. Techniques for measurement and examination are likewise discussed. The literature in each field is considered, and references are listed. One hundred and eighty-one pages of the monograph are devoted to Part II.

Part III on Medical and Clinical Aspects is the work of Dr. Lachman. It is 28 pages in length and includes methodological and diagnostic techniques for the study of the skin and its appendages, dentition, circulation posture, and physical fitness tests. Here again the literature is reviewed and citations are given.

Part IV is the work of Dr. Wolfe and has to do with Psychological Aspects. The 108 pages contain discussion of methods of measurement and review of the literature in the fields of: behavioral aspects of the skin and its accessories, sensory phenomena, perception and imagination, motor performances, intelligence and educational achievement, special abilities, sexual behavior, and personal and social reactions.

Part V, consisting of 17 pages, is by Dr. Shuttleworth and is called "Problems Not Involving Direct Measurements of Children." Measurable aspects of the environment, influence of hereditary and environmental differences, and statistical considerations are discussed. The literature is reviewed on the first two topics.

The present reviewer finishes a careful perusal of this monograph with several distinct impressions. The first is that an enormous amount of painstaking work on the part of the authors has produced a very valuable handbook. Lawrence K. Frank, in the Introductory, says that the "handbook will become progressively obsolete and deficient with every forward step in scientific work." This is, of course, true. Certainly no such compilation has been available hitherto, however, and it is questionable how soon another such will appear. In the meantime it is to be hoped that the present authors, or others, may find the means for keeping the survey current and for publishing supplementary reports at appropriate intervals.

A second impression which emerges from a study of the monograph is a question about the appropriateness of the name, stressing as it does adolescent children. Obviously, many techniques of measurement such as, for example, those of skin temperature, blood volume, lung volume, chemical constituency of urine and feces, eruption of teeth, sensory phenomena, footprints, and introversion-extroversion do not belong exclusively to adolescence. That the authors have not felt they could limit their discussion to adolescence, witness the inclusion of such a topic as a "test for pregnancy based on the presence of an anterior-pituitary-like substance in the urine of

pregnant women." One is glad, of course, that discussion and review of the literature have not been confined to the years of adolescence. This being true, however, one might wish that the name had been changed and that the whole gamut of childhood through adolescence had been adequately incorporated in the study.

A third impression of the monograph is that it will be of unequal value to the various readers for whom it was prepared—students of child growth, those concerned with diagnosis, treatment, guidance, and education of children. Obviously the requirements of these different groups of individuals vary so widely that it would be impossible in one volume to include adequate methods of study for each field. Some idea of the unequal distribution of emphasis in the present monograph can be given by saying that Blood has 90 pages devoted to it; Urine and Feces, 41 pages; Intelligence and Educational Achievement, 15 pages; and Sexual Behavior, 7 pages.

The Table of Contents is quite detailed and indicates careful organization. Nevertheless, the vast amount of minutiae encompassed within the book would be much more accessible if there were an index.

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The Adolescent Period, A Graphic and Pictorial Atlas, by Frank K. Shuttleworth. Washington, D. C.: National Research Council, Monographs of the Society for Research in Child Development. Volume III, No. 3 (Serial No. 16). 1938 v, 246 pp. \$2.00

"The volume is intended for all who are working with or studying children or youth." About 250 charts, graphs, figures, and pictures already available are reproduced, and an additional 200 or more (making 458 in all) are original drawings prepared for this monograph. "Each chart carries a brief explanation to insure that the bare facts are correctly understood, a citation of the original source, and, where it seems necessary, a few comments on the nature of the original data. No attempt, however, has been made to discuss the significance of the data or to develop their implications." The table of contents lists the following captions: introductory statistics; physical growth, physical development and differentiation; physiological functions; sexual maturation; health; intelligence; education; special abilities; plays, games, interests and attitudes; behavior maladjustments; occupational adjustments; sex adjustments; differential urban influences; major activities, age 10 to 24. Many of the charts and graphs extend considerably beyond adolescence in both directions, some reaching from birth through age 80, some from one year through 20 years, some from age six through 20, and so on. Thus is illustrated again the difficulty of separating out "the age of adolescence" for study. The mechanical setup is good, and most of the graphic representations can be easily read. The pages are not numbered, all reference being to numbered graphs or charts rather than to pages. There is, however, both an author index and a subject index.

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* Some items of minor interest to statisticians have been omitted from the list. The contents of periodical publications are not listed, but the attention of the reader is directed to the lists of articles in current publication which are to be found in the *Revue de l'Institut International de Statistique*, *Journal of the Royal Statistical Society*, *American Economic Review*, *Population Index*, *Transactions of the Actuarial Society of America*, *The Record of the American Institute of Actuaries* and *Sankhyā*, *The Indian Journal of Statistics*. Annual reports and publications presenting statistics collected at regular intervals are also omitted from this list.—Editor.

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